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PROTECTION FORESTS IN NEW ZEALAND, AND A POVERTY BAY EXAMPLE*

A. L. POOLE

DURING a parliamentary debate in 1868 the following motion was moved by a Mr Potts: 'That it is desirable Government should take steps to ascertain the present condition of the forests of the Colony, with a view to their better conservation'.[1] In those days the knowledge of botany was primitive and plant ecology had not been founded. Good, therefore, as Mr Potts's intentions were, the early settlers had no means at hand to put their far-seeing motion into effect. Nor has the matter ever been faced up to boldly.

In the intervening ninety years a great deal of forest, some of it critical protection forest, has been cleared, but the important core of protection forest fortunately remains. One could not conceive that this would ever be cleared for any purpose whatsoever; the boundaries are, in fact, more likely to be extended either by planting or by allowing natural regeneration of native scrub or forest to develop.

However, it is only now that Mr Potts's motion is being put into effect, and the task of assessing the condition of these forests is under way. The main problems related to their future management lie in assessing the changes brought about by introduced wild animals, determining how these changes affect the protective values of the vegetation, and in endeavouring to control the animals where necessary. The forests of future New Zealand, although they will contain the same plants, will be very different in structure from those known before animals entered them, and protection forest management must become a highly technical and highly developed activity. The foundation of this work must be the natural sciences—the botany and ecology of the vegetation and the biology of the animals supported by it.

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*The substance of a lecture delivered before the Gisborne Philosophical Society on 8 September 1959.

[1] *Hansard,* 7 October 1868.

Poverty Bay can pride itself that there began the recorded botany of New Zealand when Sir Joseph Banks, on Captain Cook's first voyage, collected native plants. Thus commenced the stream of excellent systematic botany that has continued right up to the present day, culminating in a current revision of the taxonomy of the flowering plants and providing botanists and others with a necessary basis to much scientific work, the study of protection forests included.

Banks may also, unwittingly, have been the first in the field of New Zealand ecology. He certainly wrote something germane to the subject when he recorded: 'We took leave of Poverty Bay, as we named it, with not above forty species of plants in our boxes, which is not to be wondered at as we were so little ashore and always upon the same spot. The only time we wandered about a mile from the boats was upon a swamp where not more than three species of plants were found.'[2] Unfortunately, however, the science of ecology had scarcely been born, otherwise Banks might have written a description of the vegetation he saw instead of mentioning incidentally the 'swamp'. Nor was this description of the vegetation ever written. Indeed, botanical recording of the district is singularly scanty in spite of the introduction to it by Banks. It is only with difficulty that some have tried to reconstruct accounts of the vegetation, including the swamps, the nature of the Poverty Bay flats and the hills covered in forest or scrub. The scrub is mostly the result of somewhat intensive Maori cultivation.

THE PRICE OF PROGRESS

With the progress of settlement the river flats soon belied the name given to them by Cook. Clearing of the rich soils of kahikatea forest, drainage and river-training work transformed Banks's 'swamp' into a land flowing with milk and honey. The transformation was not confined to the flats, and clearance of forest on the hills also revealed rich soils derived from soft tertiary rocks, and high yields and good wool prices provided the incentive for almost total clearance of forest. What was not realised, or perhaps heeded, was that the forest cover, by acting as a regulator of water and a sponge, was holding in place not only soils but complete rock formations that were minutely shattered and were singularly unstable. The change in vegetation from forest to pasture has set in motion a chain of adjustments, including soil erosion and river aggradation of the most extreme forms and has completely altered river flows. Disrupted fences, buried bridges and partly-buried homesteads and slipping roads are a mute testimony to the rapid changes going on.

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[2] Quoted in T. F. Cheeseman: *Manual of the New Zealand Flora*, Wellington, 1925, in the section, 'A History of Botanical Discovery in New Zealand'.

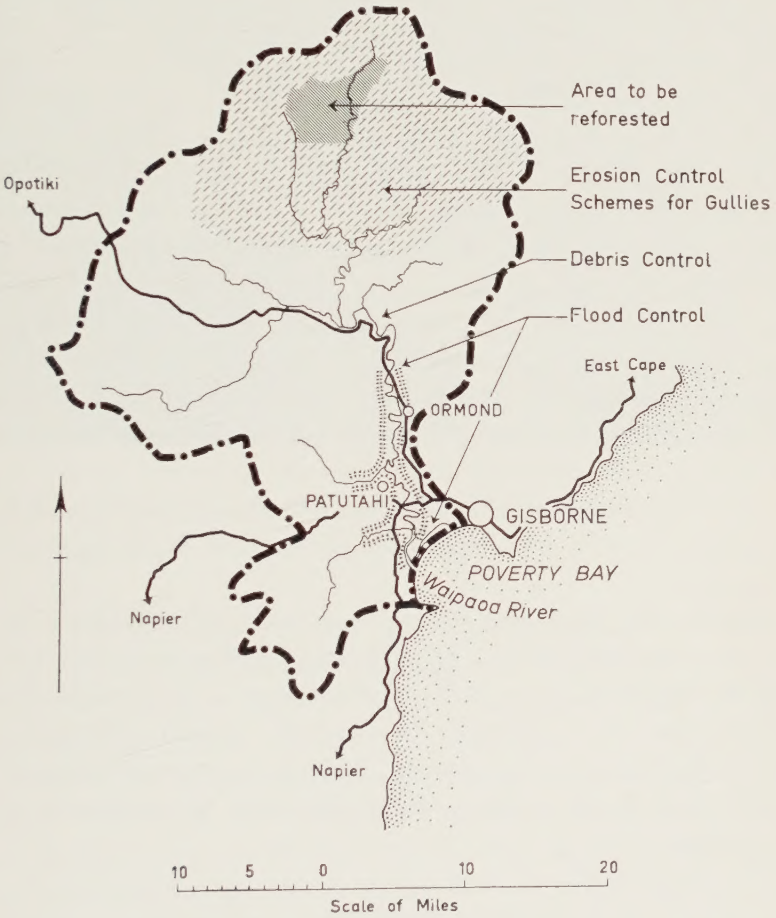

Fig. 1. The catchment area of the Waipaoa River

Engineers at first had little difficulty in designing and putting into operation drainage and river control work that enabled cultivation of the river flats to proceed. Their structures yielded large economic gains. When, in 1950, the designing of the last major stopbanking of the Waipaoa River was about to be undertaken, however, the Ministry of Works reported as follows:[3]

> It is considered probable that at the end of the loan period of thirty years it will be necessary to carry out further improvements to the scheme, as it is anticipated that it will be impossible to do other than slow down the movement of the very considerable load of debris travelling down from badly eroded areas in the upper catchment—it may take more than fifty years to bring those upland areas under any sort of reasonable control.

Once these recently-designed river engineering works were well under way, attention was turned to the condition of the catchment. A committee set up in 1957 by the Soil Conservation and Rivers Control Council, at the request of the Poverty Bay Catchment Board, was asked to examine the problem. This body reported that engineering works were required to alleviate, but not to cure, the immediate and severe stream and river aggradation; improvement of the pasture cover on the hills was necessary, but above all the liberal and extensive use of trees was called for; the rock formation giving the greatest amount of trouble—the crushed argillite (*Fig.* 2)—was to be completely reclothed with trees, and the flowing mudstones—the bentonites—should be at least partially reclothed. Unless this work was carried out the prophecy of the Ministry of Works, if it could be so described, would undoubtedly come true.[4]

Poverty Bay, then, and the catchment that lies behind it (*Fig.* 1), may be regarded as the site of a gigantic, although somewhat uncontrolled experiment, one half of which has been completed—the deforestation of a catchment, almost all the 400,000 acres of it. The other half, the partial reforestation, will take many years to complete. And it will be left to the younger and future generations to judge the results.

THE INFLUENCE OF FORESTS

The Waipaoa River and its catchment is an example of the rapid and extreme deterioration that can take place following the deforestation of certain areas. From this specific example one may proceed to a more generalised consideration of the influence of forests. This is basic to the study of protection forests. A great deal of investigation and

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[3] The report of 1950, quoted in a 1957 report to the Chairman, Soil Conservation and Rivers Control Council, entitled *The Waipaoa Catchment* (report of a special committee set up by the Soil Conservation and Rivers Control Council).

[4] *ibid.*

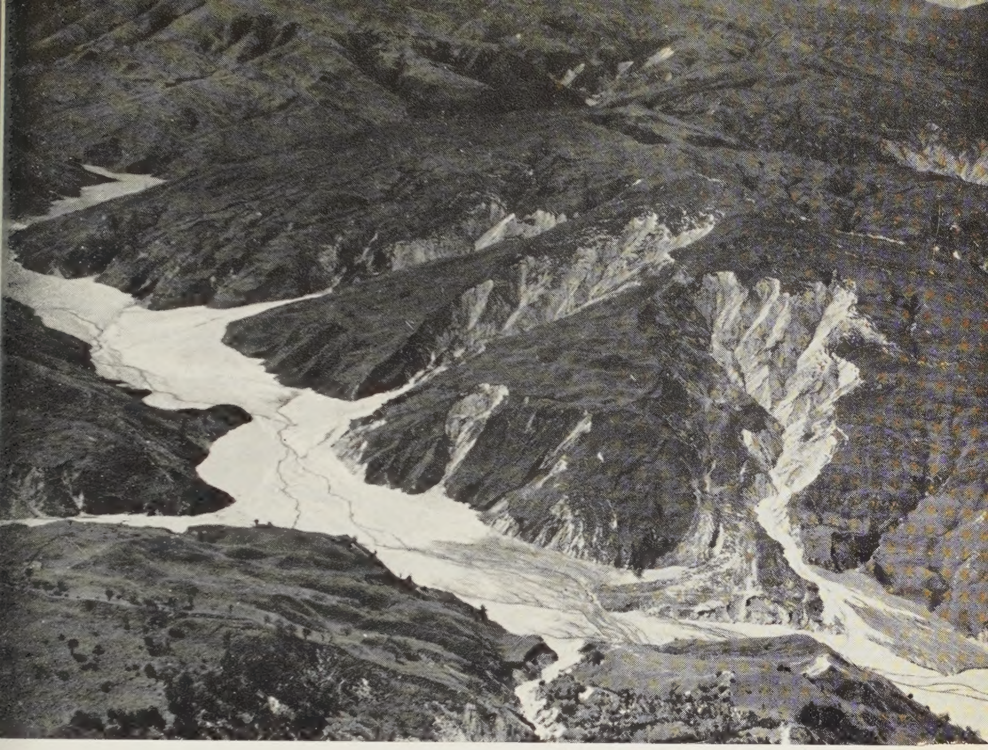

Photo: Soil Conservation and Rivers Control Cou

Fig. 2. A 'flowing' landscape in the crushed argillite of the Waipaoa catchment. This is part of the area to be forested

accurate recording has been done on this subject, most of it in the northern hemisphere. Certain facets of influence have always interested people: for example, how do forests affect the temperature and temperature fluctuations of a region, the humidity and, particularly, the rainfall? On continents extensive tracts of forest do have effects that can be measured. Forest vegetation transpires very large quantities of water and this has an effect on rainfall, temperature and humidity. No doubt in an island climate such as that of New Zealand, forest affects these climatic factors as well, though it must be to a minor extent, and this study appears not to have been warranted and has not been pursued.

What New Zealanders must of necessity be interested in is the effects forests have on water flow, on soil erosion, and on river aggradation. In primitive New Zealand the vegetation was largely forest and this had well-defined effects on these phenomena. Changes in vegetation have inevitably brought about alterations, some of them gross, as seen throughout the Poverty Bay–East Coast district.

Soil Erosion and Water Flow

There can be no question that, of all types of vegetation, forests are the most efficient controllers of soil erosion. Even so, the soils under the forest throughout most of the mountainous country in New Zealand are skeletal. This means that natural erosion under the forest canopy, mostly a multiple canopy and a dense ground cover, keeps pace with the soil-forming processes, so that no deep soils, except in pockets, are formed. Soil movement is one of the factors of soil formation. Remove the forest cover with all its hindrances to surface water movement and erosion becomes accelerated unless it is replaced by a densely-matted sward of grass. This, however, can be established only on somewhat easier slopes, on firm geological formations, and at lower elevations.

Accelerated soil erosion is not the only thing that takes place after the removal of forest. Many rock formations and perched river and glacial detritus deposits have been held on abnormally steep slopes by the dense cover of native forest. Once the cover is removed the adjustment of these slopes begins. Accelerated geological erosion sets in. That has occurred with rapidity in the soft rocks throughout the Poverty Bay district and in shingle terraces perched high up in the steep valleys of Westland. It is occurring more slowly, but nonetheless insidiously, in the hard rocks all along the eastern side of the South Island where beech forests and tussock grasslands have been burned. It remains for the engineer to say what will happen to the huge additional quantities of rocks which are being fed into the streams and river courses. Can our rivers cope with them? The answer has already been given for the Waipaoa River.

Thus the threat of accelerated erosion, both soil and geological, if the forests of the mountains are damaged or destroyed, is one reason why they are so important. But New Zealanders cannot afford to have forest on all their hills. It is legitimate to clear so long as the forest makes way for permanent production and provided that the lowlands, both urban and rural, can protect themselves economically from the consequences. There is no doubt that on these scores the clearance of hill and mountain forest has proceeded too far and in many places, as for example in the catchment of the Waipaoa, there must be some reversal.

From the viewpoint of water control the ideal would of course be a regular flow of clean water down all rivers; but this is remote from the realms of possibility. New Zealanders are, however, fortunate insofar as a number of large rivers are buffered by lakes. No vegetation could possibly regulate the flow of these rivers to anything approaching the same extent that the lakes do. There are also very large and, in places, deep deposits of pumice. Because of their permeable nature these regulate water flow much more effectively than any vegetation could. The majority of New Zealand rivers, however, neither flow from lakes nor do they pass through pumice deposits. Most are unruly and affect the urban and rural populations in the lower reaches. They have, in fact, built up the extensive flood plains upon which many of the people have settled. What happens in the catchments is, therefore, of the greatest concern to these lowland populations and occupations.

Of all vegetation, forest is the most efficient regulator of water flow. Rain that passes through a multitiered forest canopy and is absorbed by the ferns, mosses and litter of a good forest floor must be delayed in its absorption and flow through the soil; the rate at which it reaches streams must be retarded. Moreover, forests transpire more water than any other type of vegetation. There are already one or two examples in New Zealand where the planting of small, troublesome catchments with trees has completely dried up the flow of water and, incidentally, has stopped the movement of shingle and boulders. Stony Creek in Ashley State Forest is one such example. In the United States catchments are sometimes cleared of forest so that the total yield of water for domestic purposes will be increased. Compared with other types of vegetation, forests even out the flow of rivers. It is always emphasised by engineers, however, that they do not lessen the height of flood peaks because these usually occur when both vegetation and soil are already saturated by heavy rainfall. Engineering works are a necessity in the lower reaches of almost all rivers to provide for drainage of low-lying land and to prevent flooding, especially disastrous flooding at peak flows.

Harnessed Water

Any consideration of water flow must encompass the question of harnessed water, an essential commodity of civilisation. The use of water by peoples is an intriguing study and one that seems, to the outsider, to require much more attention than it is has received in the past, although some countries which use very large quantities of water and have large urban populations are now beginning to study supplies in detail. The bounteous water in most parts of New Zealand lulls most into a sense of security so that little thought has been given to these matters except the case of water supplies for irrigation of dry country.

In some of the densely-settled parts of Europe the shortage of water for industry has been one of the main factors limiting population. In those parts necessity has been the mother of invention, and the use and reuse of water is made possible by a most highly developed technology. In the United States of America water supplies are now studied in considerable detail. Modern industry is pushing the *per capita* consumption higher and higher and it would seem that in parts of California water soon is likely to be the commodity limiting industrial, and hence population, growth. Investigations are being conducted into the possibility of obtaining freshwater supplies from the sea.

In New Zealand greatly increased supplies of water must be harnessed for expanding industries and population, for hydroelectricity, and for irrigation. To date, supplies have been so easily obtained that the only hydrological studies have been comparatively crude measurements of stream and river flows obtained mostly in connection with the design of river-control engineering.

The most valuable water in New Zealand is undoubtedly that flowing down the Waikato River. Its value must increase, and no doubt the Waikato Valley Authority will in time be concerned with the vegetation growing within the river catchment. Paradoxically, engineers are inclined to regard forest in this area as one of the factors reducing the amount of water flowing into Lake Taupo. Here, then, forest may be a hindrance to the aim of engineers and, moreover, because of the deep pumice deposits, is not generally needed for preventing soil erosion.

In direct contrast is the harnessing of the Waihopai River for hydroelectricity. The dam, constructed on the basis of water flow, ignored the eroding condition of the catchment and in a very few years the dam was filled. This is but one example of a great many similar ones to be seen throughout the world.

PROTECTION FORESTS

Although the technical details of what has been described were not generally known to the early settlers of New Zealand, nevertheless the effects of transgressing the well-known principles were soon so obvious that, by a kind of 'hit and miss' method, most mountain forests were left intact from quite early times. They are now universally recognised as protection forests, even though not legally called such. Their importance to the country is at least as great as that of the commercial forests, and it would not be difficult to foretell what would happen if mountains were denuded of them. Damage to roads and to railways, to cities and to farm land on the floodplains would be appalling. Legislators are at the moment grappling with the problem of how to block the last loophole in controlling activities in protection forest—that is, in privately-owned, or in the equivalent to privately-owned, forest.[5]

Meantime, serious study will have to be given to those catchments where protection forest must be re-established. The first such major scheme is being planned for the Waipaoa catchment where soft rocks, fertile soils and good climate should allow quick rehabilitation. Poverty Bay is more fortunate than some other parts of New Zealand where, to use a modern expression, the point of no return—or of very difficult return—has been reached.

Ownership of Protection Forest

Although there is little doubt in the minds of the administering authorities about the future retention of protection forest there is considerable public uneasiness and distrust of present legislation. This derives in part from the logging taking place in the Urewera forests. How much more of this is to take place? Can it be controlled? Is the forest to be cleared?—all important questions, especially to those who live by the rivers flowing from the Urewera to the Bay of Plenty. It is important therefore to consider protection forest in terms of tenures and of the laws governing these tenures.

It has been estimated that there are 14.5 million acres of indigenous forest remaining.[6] Of this about two million acres are exploitable forest which will be milled and then much of it managed for perpetual supplies of produce. Some will be cleared for agriculture, but not a great deal. Some forest has been logged over and is unmanaged. The remaining 11.7 million acres, or about eighteen percent of the area of New Zealand, can be classed as protection forest, and its ownership is shown in Table I.

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[5] Power has now been taken into consideration in Part II of the Soil Conservation and Rivers Control Amendment Act, 1959.

[6] S. E. Masters, J. T. Holloway, P. J. McKelvey: *The Indigenous Forest Resources of New Zealand*, (National Forest Survey of New Zealand, Vol. I), Wellington, 1955.

National Parks and Scenic Reserves

These are set aside for the preservation of natural scenery, whic perforce must include the natural vegetation, and, incidentally, fo recreation of certain types such as skiing and tramping (*Fig.* 3). Th national park movement, which originated in the United States at time when the country was being settled, was aimed to secure fro the advance of that settlement natural areas of outstanding beaut

Concern here is with the vegetation. Legislation says that this is to b preserved in as natural a state as possible.[7] It says that exotic plants ar

TABLE I

Ownership of Protection Forest

Form of Ownership	*Area in Acres*
State forests	5,300,000
National parks and scenic reserves	2,400,000
Unoccupied crown lands	1,600,000
Maori land	800,000
Freehold and leasehold	1,600,000
Total	11,700,000

to be eliminated—a laudable aim but one now impossible of achievement because of the changes both great and small brought about b wild animals to plant cover. These changes allow the encroachment o exotic plants. The act also lays down that the parks shall be maintaine for 'soil, water and forest conservation . . . . .'. Provided that th protective value of the vegetation is not impaired by introduce animals, therefore, the 'locking-up' of an area under the national park legislation serves the national needs in these matters. Should th vegetation become badly depleted, however, it is improbable that park board would, or could, pay the necessary attention to the problem or would even allow much interference from other organisations t correct the position, especially if this involved the erection of structure or the use of exotic plants.

These, therefore, are the strengths and weaknesses of national park legislation insofar as it prescribes for the management of protectiv vegetation, including forest. It is important to note that park boards already have difficult wild-animal problems on their hands. The main concern of the Urewera National Park—for which no board has yet been set up—is undoubtedly the depredations caused by red deer, goats and opossums, to which will soon be added those caused by Japanese deer and, possibly, wallabies—a formidable list of browsers. The Egmont National Park is clothed mostly with invaluable protection forest and its board has to direct much staff and money to combating goats and opossums. All the South Island parks, in particular the Fiordland National Park, have large wild-animal populations. A census would, n fact, probably show that the main users of Fiordland are hunters.

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[7] See the National Parks Act, 1954.

Photo: N.Z. Forest Service

Fig. 3. Mount Ruapehu, Tongariro National Park

Because of the complete restrictions on any form of forest exploitation contained in the national parks legislation, there has been much upport, official, political and public, for the placing of indigenous orest, particularly protection forest, in national parks. Such thinking s the natural outcome reflecting a revulsion against the continued destruction of forest and the seeming inability of any other legislation o halt it. For these reasons mainly the large extension to the Urewera National Park (334,000 acres in 1958) was made. The area conforms n no way to the legal reasons contained in the National Parks Act for creating parks. Provided that adequate safeguards can be found—an they are being strenuously sought for—to control activities in an protection forest,[8] the above type of reservation is an unwarranted us in fact a misuse, of national parks legislation. It precludes, virtuall for ever, any use, other than recreation, being made of these forest

In order to show the swing of the pendulum that can take place i thinking on such matters, it is only necessary to go back some thirt years. In 1924, 28,000 acres of the Urewera block were subdivided an extensively advertised for public selection—but no sections were take up! Other plans were afoot for the much wider opening-up of th Urewera. It is surely a reflection on public opinion and on governmen policy on such a basic issue as land use when it takes but three and a hal decades for the pendulum to swing completely the other way—from removal of forest to a tight locking up.

At the same time as plans for opening up the Urewera were bein formulated a much saner view on the use of the area was expressed b the Director of Forestry who reported to his Minister:[9]

> Is the natural wealth of the Urewera country to be destroyed and the futu prosperity of one of New Zealand's richest farming districts to be imperilled b scheme of wholesale subdivision and so-called settlement: or is the Urewer country to be made into a prosperous sylvo-pastoral community yielding ever-increasing wealth and ensuring in perpetuity prosperity and wealth of thousand of people in the widespread low-lying fertile lands of the Rangitaiki, Whakatan and Totara plains, to say nothing of the future of the local Maori race? This paper will endeavour to show that the interests of the Dominion will best be served by the dedication of the Urewera country as a permanent forest to be used for timber crop production, water conservation, stream flow regulation, subordinate sylvo-pastoral settlement by Europeans and Maoris and for national recreation and sporting purposes.

While it must be admitted that forest clearance has proceeded too far in mountainous country, that does not mean to say that the remaining indigenous forest should be 'locked up'. It is much too early in the stage of development of New Zealand to do this. The question is discussed again under state forests.

STATE FORESTS

These are administered under the Forests Act, 1949, which is a '..... Law Relating to the Management and Protection of Forests and Forest Land .....'. In forests and on forest land the Minister of Forests

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[8] They are now contained in the Soil Conservation and Rivers Control Amendment Act, 1959.
[9] New Zealand Forest Service official files.

Photo: N.Z. Forest Servic

Fig. 4. Silver beech forests in the headwaters of the Lillburn River, Southland. An example of 'multiple-use' forest, functioning as protection forest, but also utilised for timber

may do any or all of the many things prescribed in the act. Exploitation is, of course, allowed. The matter of concern here is provided for as follows: 'The Forest Service, under the direction of the Minister . . . . . shall have exclusive control and management of: (a) All State forest land, whether for the production of timber or other forest produce, or for the protection of the land with a view to water conservation or soil stabilisation, or for ensuring the balanced use of the land . . . . .' This places an obligation on the minister and the service to recognise and have regard for protection forest.

Current policy of the New Zealand Forest Service for the management of protection forest can be explained as follows. The vital role that protection forest, and protective vegetation generally, play in the economy of this country is recognised and emphasised. In the management of these forests all objects of management are subordinated to the aim of preserving the protective function. A survey of the mountain forests is being undertaken to determine their condition and so lay the basis for adequate management. The wild-animal populations are being studied and considerable thought is being given to the improved control of them, though it is admitted the problems are formidable.

In spite of the full realisation of the function of protection forests a forester—and the Forests Act—does not admit any single use for any forest land (*Fig.* 4). There is always a dominant use; but a single use curtails the productivity of the land, using productivity in its widest sense to include such things as recreation. A parallel is to be seen in tussock grassland vegetation where a dual use is made of what is some of the most important protective vegetation in the country. In fact sheep production is the dominant use, whereas the reverse should be the case and water production and soil conservation should be placed first. The term 'multiple use' has been coined by the Americans for the management of their forests and this term expresses the foresters' aim admirably. In most of the mountain forests of New Zealand the Forest Service would recognise only one management aim—protection; but in many places the dual purpose of production and protection can be served without the one affecting the other. This dual use must occur because of the pressure that will be brought to bear in time to come on forest land for the winning of forest produce.

PLANS FOR MULTIPLE USE

In the Forests Act there is provision for working plans which are documents that have to be approved by the minister and cannot be altered except with his consent. They can be drawn up for periods up to twenty years and are revised at the end of the specified period. In them the objects of management are laid down.

Working plans have now been compiled for several protection forests, of which the Tararua State Forest is one. In this the objects of management are set out as: (a) in general, to achieve the optimum land use for the area by a multiple-use concept of forest management; (b) in particular, to protect and conserve the vegetative cover with a view to minimising soil erosion, regulating run-off and conserving domestic water supplies; and (c) insofar as it is compatible with (b), to develop the recreational and amenity values of the forest and to administer the area as a national forest park. This plan has been made available in printed form for all to study.[10]

Enough has been said to emphasise that the accepted principle of forest management of foresters is 'multiple use'—that they will give due emphasis to protection needs for they are trained to look after forests

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[10] New Zealand Forest Service: *Working Plan for Tararua State Forest No. 31*, Wellington 1954.

Photo: N.Z. Forest Service

Fig. 5. Mountain beech protection forest near the upper limit of forest vegetation. Deer have destroyed the tier of shrubs and the ground ferns

and to take a long-term view. To them in fact will fall the lot of eventually patching up much damaged protective vegetation throughout the country. The Forest Service is already burdened with the control of noxious animals which are affecting protective vegetation more than any other agency (*Fig.* 5).

Freehold, Leasehold and Maori Land

The Urewera and adjacent country contains a large proportion of the forest on Maori land that could be classed as protection forest. Maori land is the equivalent of private land in that there are no restrictions as to how it can be used or what is done with forest growing on it. When, not more than a few years ago, logging moved into the Urewera in earnest, the best the government could do, in the absence of any restricting or controlling legislation, was to reach a verbal agreement with some Maori owners to log so as to safeguard the real protection forest. This agreement included the desire of government to purchase unlogged, as well as cutover forest. This position was vulnerable because it had no backing in law. The agreement has therefore not been observed by all owners or loggers. It is for the correction of this situation, in protection forest of any tenure, not only Maori, that the government is now trying to find a formula.

A much larger area of protection forest lies on freehold and leasehold land. This is just as vulnerable as that on Maori land.

Unoccupied Crown Lands

These are usually lands which the government has not finally decided how to classify. Very limited areas only are now suitable for settlement. Most will eventually find their way into national parks and reserves and into state forest.

Conclusion

Protection forests are an essential part of the soil at higher, and frequently at lower, altitudes in New Zealand. It is important for all people to know of the functions they serve. Flooding of the Poverty Bay flats of the Waipaoa catchment has forced many people to realise what effects can follow in the train of wholesale destruction of protection forest. In that catchment the government has been compellec to take a major step on the soil conservation matters of river control

THE CHANGING POPULATION OF WELLINGTON CITY: 1926-1956

R. J. W. NEVILLE

'A CITY, unless it has ceased to have other functions than to serve the purposes of archaeology, is always in transition.'[1] Aspects of change in New Zealand cities are often commented upon, but less frequently is any attempt made to study objectively a particular process or phenomenon. This paper is a summary[2] of an attempt to describe and explain, at least in part, the depopulation of the central cores of these cities, and the city of Wellington has been chosen as a clear example of this trend.

TABLE I

ANNUAL PERCENTAGE GROWTH OF POPULATION

Intercensal Period	*New Zealand*	*Wellington*
1921–1926	2.1	2.1
1926–1936	1.1	1.6
1936–1945	1.1	1.1
1945–1951	1.9	−0.9
1951–1956	2.3	0.4

In terms of population numbers Wellington is a city in decline. Census totals since 1945 have, on both occasions, recorded a decrease in the number of people living within the administrative boundaries of the city.[3] In 1945 there were nearly 127,000 people living in Wellington, the highest figure that the city has recorded at any census. By 1951 this figure had declined by 2,500 to 124,500; and by 1956, had decreased by a further 2,500 to 122,000.[4]

These periods of local decline occurred during the decade of postwar boom in population when the country recorded its highest rates of increase since the first quarter of this century. (See Table I.) Of the larger urban centres in New Zealand, Auckland between 1945 and 1956 increased by nearly 12,000 and Christchurch by 24,500, but Wellington declined by 5,000. Beyond the boundaries of the city, in the area which might be termed greater Wellington, the trend was completely different. In the same period, when Wellington city had declined by 5,000, there was an increase there of 41,000, or sixty percent, indicating a considerable overall growth in the metropolitan area.

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[1] Miles L. Colean: *Renewing Our Cities*, New York, 1953, p. 5.

[2] The arguments and conclusions discussed here are much more fully dealt with in a thesis of the same title presented for the M.A. degree, Victoria University of Wellington, Wellington, 1959.

[3] The present-day city boundaries extend northwards as far as Johnsonville, skirt to the west of Khandallah, Ngaio and Karori, and follow the Happy Valley Road to the south coast.

[4] Comparable totals for the cities of Auckland and Christchurch in 1956 were 137,000 and 143,000 respectively.

Why, then, when increases had been so substantial elsewhere, was growth so slight in Wellington? Why, when other cities were benefiting from the large postwar increases did the population of Wellington city show a marked decline in numbers? And of what significance is this trend to Wellington?

Sequence of Population Change

Within the city, growth of population has been very unevenly distributed both in time and space. Some outer suburbs such as Karori and Miramar have recorded a long period of sustained growth, whereas some inner suburbs such as Kelburn and Wadestown reached their maximum populations some ten or twenty years ago and have remained more or less static ever since. However, older districts near the centre of the city have steadily been losing population, and although this trend has been temporarily reversed in some instances, the overall tendency has been one of migration from central districts.

A series of maps (*Fig.* 1) which depicts the changes in population numbers between successive censuses shows clearly what has happened. There has been an accelerating and spreading decline in population numbers in the central portion of the city, and since 1945 numerical increases in other parts of the city have been inadequate to compensate for this cumulative decline, with the result that there has been a decrease in the total city population. At first the area in the heart of the city recording a decline was very limited and the population numbers involved were very small. However, this decline subsequently assumed far greater proportions and recently has extended to include a belt of suburbs from Kaiwharawhara to Seatoun.

Prior to the intercensal period 1921-1926, successive censuses had recorded a steady growth of population in all suburban divisions and a steady, if small, increase in the central city; in 1921, the Central Area[5] had a population of nearly 35,000, the highest total it has ever reached. Between 1921 and 1926, the first indication of a significant loss of population in the Central Area became evident. Te Aro with a population in 1921 of nearly 10,000 declined by 800, or eight percent. This was the largest decline at the initial stage, but it was not the only one; Lambton with a population of 6,000 lost 115 and Thorndon with 7,700 lost five—losses small in themselves but significant in the light of the current trend in Te Aro and subsequent developments throughout the Central Area.

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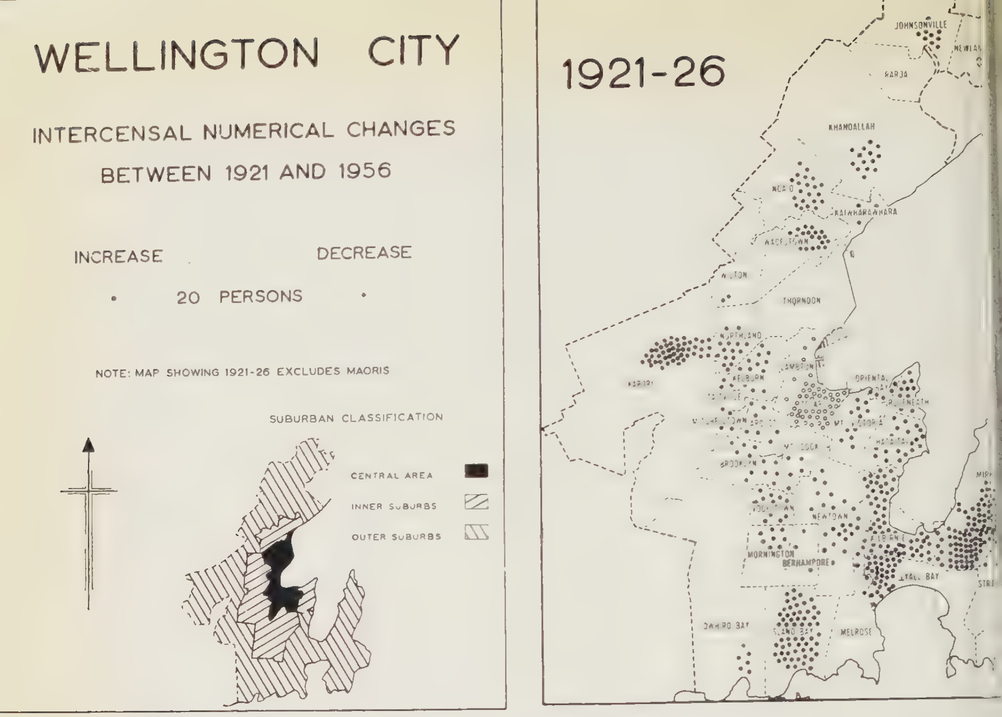
[5] The Central Area comprises the districts of Thorndon, Lambton, Te Aro, Mount Cook and the western slopes of Mount Victoria.

Between 1926 and 1936 there was again a considerable decline in the population of Te Aro (twelve percent). The only other negative change was in Thorndon which experienced a moderate loss. However, despite the substantial loss in Te Aro the net change in the Central Area was a small gain; nevertheless the tendency towards permanent and substantial decline had clearly established itself in the heart of the city. Not only so, for there was a suggestion that the decline might be spreading: Kaiwharawhara, Newton and Berhampore each showed a small decrease.

The period between the 1936 and 1945 censuses brought a further confirmation of the malignant nature of this new malady of decline, for it spread into previously unaffected localities. For the first time the Mt Cook and Mt Victoria divisions recorded a population loss. There was a movement of more than 1,700 persons out of the Central Area, and of these nearly 1,300 were from Te Aro. By 1945, in a little over twenty years, there had already been a loss of one third of the population of that district.

Effect of the Second World War

The second World War had its effect too, and there can be little doubt that this temporarily stayed the trend in the northern part of the Central Area. Thorndon and Lambton, which both recorded substantial increases, were then, as now, the locale of many temporary lodgings, and it was to these districts that many people came from outside the city as part of the considerable movement of voluntary and directed manpower. This movement resulted from the wartime concentration of oversea shipping at the main ports, the intensification and expansion of industries such as clothing and munitions, and the accelerated tempo of rural-to-urban drift. After the war some people



returned to the smaller centres, and this contrasting movement must, in part, account for the magnitude of the decline in population in Wellington between 1945 and 1951.

During this period 1945 to 1951, however, the trend of accelerating decline appeared more strongly than ever, and all five districts comprising the Central Area were affected—for the first time concurrently—by depopulation. Again the heaviest loss (twenty percent) was from Te Aro, reducing the population of this district to a little more than 5,000, or about half its 1921 population. Thorndon recorded a loss of nearly 1,500, which was almost as large as the numerical loss from Te Aro; and the population of each of the other three districts was reduced by several hundred, with the result that the Central Area had an overall loss in this five-year period of more than 5,000, or an average loss of 1,000 a year. But the districts affected were by no means confined to the Central Area. A solid, unbroken belt marking the area of decline now extended from Kaiwharawhara through the Central Area to Kilbirnie and Lyall Bay, and recorded a total decline of 12,500. A total increase of 10,000 in other suburbs was inadequate to compensate for this fall in numbers, and consequently the population of the city declined by 2,500.

Between 1951 and 1956 there were further heavy losses. The population of Te Aro was reduced by 850 and each of the other divisions in the

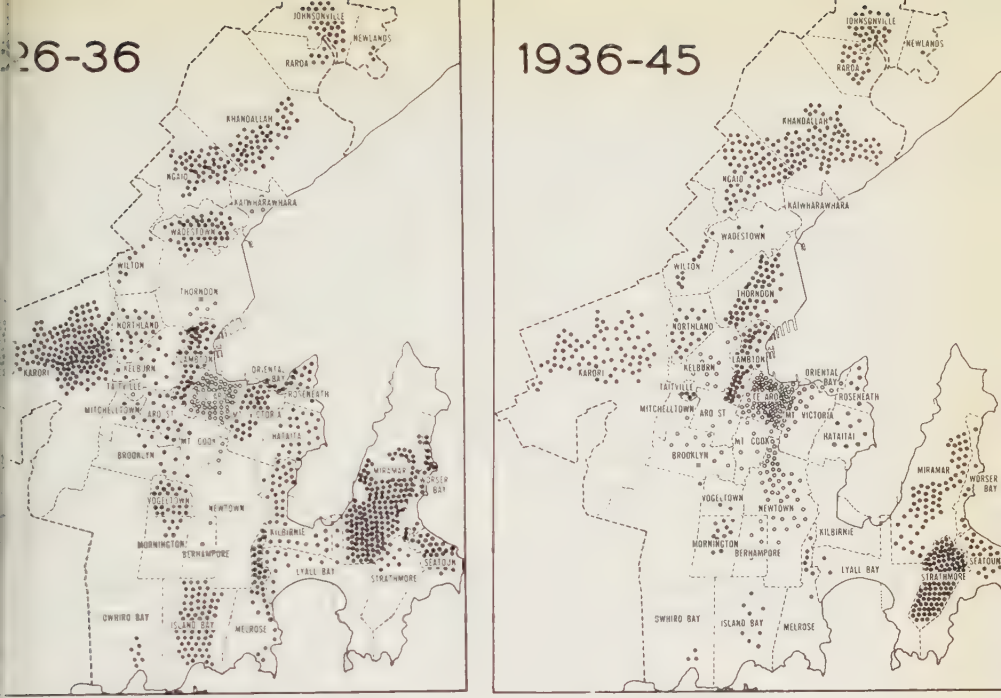
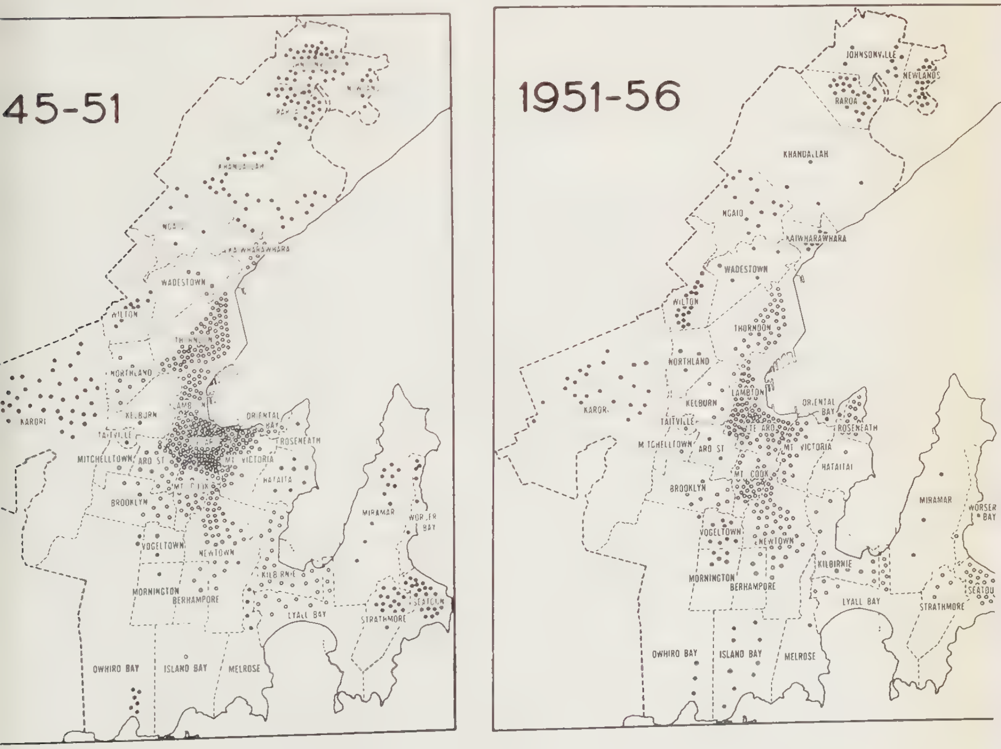


Fig. 1. Intercensal numerical changes between 1921 and 1956 in the population of Wellington: left, 1921–1926; above, 1926–1936 and 1936–1945; below, 1945–1951 and 1951–1956. (Dots represent increases and circles decreases, each of twenty persons)



Central Area recorded a decrease of between 300 and 700, giving an average overall loss for the period of 600 a year. The most significant feature of this period, however, was that it marked the maximum areal extent of decline—from Thorndon in the north, right out to the eastern suburbs of Strathmore and Seatoun. From all city divisions recording a decline between 1951 and 1956 the total outward movement amounted to 8,500 persons; and never before had there been such a small proportional increase in the new and developing suburbs. The outcome was thus a further net loss to the city of 2,500.

Here, then, is a situation in which a city with an increasingly important local, regional and national function as a commercial and administrative centre, is, within its limited statutory boundaries, declining in population. But this steady trend of depopulation of the Central Area is—even within New Zealand—far from unique. Although the trend is highlighted in Wellington by the overall population decline of the city, the other three major centres of Auckland, Christchurch and Dunedin have recorded, for a roughly similar period and on a comparable scale, a considerable decrease in central-city populations; and the smaller cities have more recently begun to follow the same trend.

TABLE II

AGE AND SEX STRUCTURE IN THE CENTRAL AREA AND WELLINGTON CITY, 1956*

Age in years	0–15	15–30	30–45	45–60	60–75	*Over 75*	*Total*
Central Area:							
Males	6.0	14.0	10.7	10.9	6.9	1.7	50.2
Females	5.9	12.1	9.7	10.9	8.2	3.0	49.8
Total	11.9	26.1	20.4	21.8	15.1	4.7	100.0
Wellington City:							
Males	11.2	11.1	10.2	9.5	5.4	1.4	48.8
Females	11.0	10.6	10.8	9.9	6.6	2.3	51.2
Total	22.2	21.7	21.0	19.4	12.0	3.7	100.0

*Figures are percentages

SOME DISTINCTIVE CHARACTERISTICS OF THE CENTRAL AREA

Despite the movement of people away from the Central Area, in 1956 more than 26,000 people, or one fifth, of the city population of

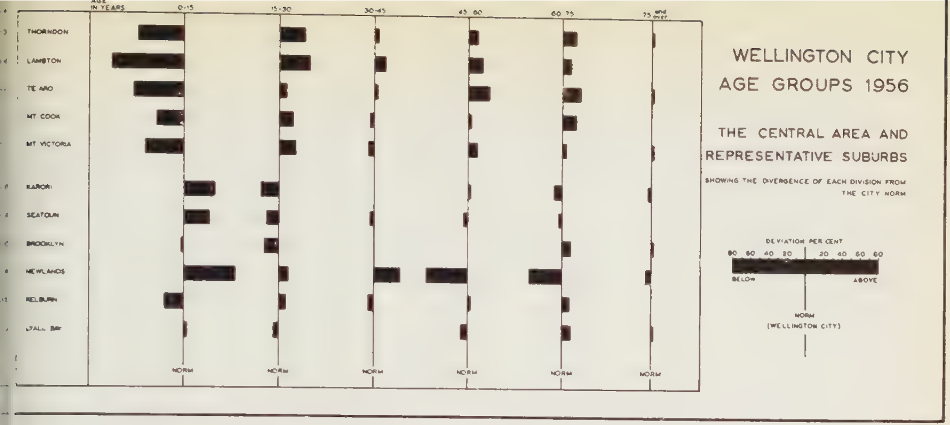


Fig. 2. Age groups in Wellington: the Central Area and some representative suburbs

Wellington still lived there. The two questions that naturally arise are those concerning the people themselves and the possibility of any perceptible difference between this particular group of people and those who live in the remainder of the city.

The Central Area shows a distinctive pattern of groupings at all ages and particularly for those under thirty. (See Table II and Figure 2.) By city standards the Central Area has a very large deficit of children under fifteen. In Wellington at the 1956 census 22.2 percent of the population were children under fifteen, but children in the Central Area comprised only 11.9 percent of the population found there. This state of affairs is reversed in the 15-30 age group. On the average, Wellington has 21.7 percent of its population between 15 and 30 years of age, but the Central Area averages 26.1 percent, and one division in the Central Area reaches 28.7 percent.

In the older age groups also there is a distinctive pattern in the Central Area but it is not as pronounced as for the younger ages. The 30-45 age group comprises about an average proportion of the population, but in the groups from 45-75 years of age there is again a clear indication that people of these ages tend to favour living in the Central Area. It is also noteworthy (Table II) that although the population of Wellington city has a distinct preponderance of females, this is not reflected in the population of the Central Area which has a slightly larger proportion of males.

Probably of greater significance in the composition of population in the Central Area is the marital status of those exceeding sixteen years of age. For both sexes and at all ages over twenty the Central Area has a disproportionate share of those who have never been married (thirty-five percent as against twenty-four percent for the city). Conversely the proportion of married people in the Central Area is relatively low, and only in the youngest groups (which are largely composed of couples with no families) is there a distribution anything like normal. The Central Area also attracts those who are widowed or divorced; nearly a third of those in the city in this category live in the Central Area.

It is therefore evident, even from so brief a description of the population at present living in the Central Area, that those most attracted to it are in the younger age groups, mostly unmarried, or married but childless; and older people, many of whom are widowed. There can be little doubt that the central location is most attractive and convenient for those who have no family responsibility but whose interests are mostly to be found in the centre of the city.

TABLE III

POPULATION AND ALL DWELLINGS IN THE CENTRAL AREA: 1926, 1936 AND 1956*

1926				*1936*				*1956*			
Population		*Dwellings*		*Population*		*Dwellings*		*Population*		*Dwellings*	
Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
34,365	*34.6*	7,262	*32.8*	34,534	*29.9*	7,165	*26.5*	26,530	*21.7*	6,840	*20.0*

*Percentages are of the city totals

A further aspect characteristic of the population of the Central Area is the number and type of dwellings[6] in which these people live (Table III). With the steady fall in population numbers has been associated a decline in the total number of dwellings in the Central Area: thus, in 1926, thirty-five percent of the city population lived there and occupied one third of the city dwellings; in 1936, thirty percent of the city population lived there and occupied twenty-seven percent of the city dwellings; in 1956 the figures were twenty-two percent and twenty percent respectively.

Thus, while the population of the Central Area declined by nearly twenty-three percent over the thirty-year period from 1926 to 1956, the number of dwellings also declined, but at about one quarter the rate—by six percent. The outcome of this trend was therefore a decline in the number of occupants per dwelling from 4.7 in 1926 to 3.9 in 1956. A figure of 3.9 occupants per dwelling is very low[7] when it is considered that so many hotels, boarding houses and hostels are located in this part of the city and accommodate up to several score each.[8] The actual net loss of some 420 dwellings, despite the erection of a number of blocks of flats, relates clearly enough to population decline but does not help to explain the falling rate of occupancy.

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[6] Hotels, hostels, hospitals and similar institutions are included in the 'all dwellings' classification but are excluded from that of 'private dwellings'.

The predominance of certain types of dwelling in the Central Area is also noteworthy. In the city, three-quarters of all private dwellings are of the detached unit type and twenty-one percent are flats; in the Central Area, forty-seven percent are detached units and forty-six percent are flats. The non-permanent nature of much of the population in the Central Area is further emphasised by the high proportion of units in the private dwellings classification inhabited by non-owner occupants. In the Central Area, sixty-four percent of the private dwellings are rented and thirty-six percent owner-occupied compared with thirty-seven percent rented and sixty-three percent owner-occupied in the whole city.

Basic Causes of Population Change

It is a truism to say that the causes of this depopulation in the central city are varied and complex, but in view of this complexity it is possible to isolate only a few of probably the most important factors involved.

To maintain a proper perspective in this particular study, two basic points must constantly be kept in mind. First, although this article is chiefly concerned with the depopulation of the Central Area, the magnitude of the changes on the periphery of the city has been much greater. The much wider metropolitan area, as opposed to the city, is steadily growing and this urban growth is part of a national trend towards greater urbanisation. In fact 'this drift to the towns is a world-wide tendency and . . . marks a certain stage of development in the internal economy of the country'.[9] It is evident therefore, that any attempt to explain the problems of central-city depopulation must take into account the complementary aspect of population change—

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[7] The figure for all New Zealand, including Maoris, in 1956 was 3.6 occupants per dwelling.

[8] Two-thirds of the boarding houses and hotels in the city are located in the Central Area, and the 36 hostels there accommodate nearly 1,700 residents.

[9] *Population Census, 1956*, Vol. 1, 'Increase and Location of Population', Wellington, 1957, p. 23.

peripheral growth. Second, not only is this peripheral growth a widespread characteristic, but the phenomenon of central depopulation is also far from unique. As early as 1833 it was commented upon in the United States and today is a matter of concern to many people with varying responsibilities and interests.[10]

Premium on Space

Underlying most of the observable changes in New Zealand cities is one basic need—the need for land. There is a premium on space, particularly readily accessible space, and all users of the land cannot compete for it on equal terms. Housing, commercial and industrial interests compete for the use of land and premises—with housing fighting a losing battle in most instances. In Wellington, houses and even some old shops are being put to new uses as workshops and small factories; established industries are expanding on to adjacent sites: companies establishing new industries are demolishing old housing and erecting modern plants.

This is a change largely confined to the Central Area. Some of these new industries are relatively large, but many are owner-operated and employ few assistants. Many of the smaller businesses have been located on the fringe of the main business area, close to commercial activity and business contacts, but sufficiently distant to avoid high rates and rentals and the worst of the traffic congestion. These industries are clearly a necessary part of the increasingly diverse functions of the city and are therefore entitled to a place in its functional core. However, their nature is such that they cannot compete for the most accessible and frequented parts of the Central Area occupied by the pre-emptive users of land such as the retail trade, but they are able to displace housing to occupy the fringe of the central business district.

The demand for land is also reflected in the high land values in some parts of the city. It is sufficient in this regard to cite one example: in one area on the outer edge of the Central Area, the unimproved value on land recently used for residential purposes rose by 300 percent in the six years from 1949 to 1955.[11] The individual householder, unless he has a very strong reason for staying, is therefore practically obliged to move away from the inner fringe of the residential area.

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[10] See for example: 'Exploding Cities', *The Economist*, London, 4 January 1958, p. 35, *et seq.*; and also, Editors of Fortune: *The Exploding Metropolis*, New York, 1958.

[11] An area situated in lower Kent Terrace, Wellington; in contrast, the average city increase was about 50 percent over the same period.

Much of the property remaining in housing is held by owners hoping to convert it profitably to commercial or industrial uses, or simply to continue to collect rentals which are often excessive for the dilapidated and overcrowded facilities offered.

The establishment of industry among housing has a depressing effect on the remaining dwellings. The factory or premises themselves, the associated noise and smell, the additional movement of heavy traffic, all contribute to the disadvantages attributed to industrial extension in to residential districts. Such an area becomes decreasingly desirable residentially and is the more readily taken over by industry.

A factor of some importance, not only to the Central Area but also to the whole city, is what may be termed normal population growth. It is customary in New Zealand for children reaching adulthood, particularly as they marry, to leave their parents' home and establish a home of their own. Where this initial movement occurs no house becomes vacant and there is simply a numerical loss of population to the district. This is considered to be a major factor in explaining the fall in population of some of the older suburbs.

The shortage of suitable land to build on is self-evident in the more central parts of the city. Much of the Central Area, outside the main commercial core, is occupied by dwellings providing temporary accommodation. The remainder, where it is suitable for private dwellings, is built over. It is therefore inevitable that those desirous of building a house should do so out in the suburbs, usually in the outer suburbs or beyond the city boundary altogether.

Policy of Mortgagees

However, it is not only lack of land that encourages people to build in the suburbs and beyond. It has been the general policy of companies advancing loans to encourage, by better terms, the building of new houses rather than the purchasing of existing ones. In 1957, it became the declared policy of the State Advances Corporation in New Zealand to grant loans for housing only if a new house were to be erected. Such a policy must inevitably weigh heavily in persuading people to settle in either the outer city suburbs or beyond.

It is easy, however, to overlook the fact that people act as independent individuals rather than as a disinterested mass. Within New Zealand most people usually have definite preferences and ideals which make it desirable for them to achieve certain standards and associate with particular groups of people. One elementary example of this is the very common preference for detached-unit housing located on the traditional quarter or one-fifth acre section. It becomes the aim of many young people to own such a property in a locality to their liking. Here again the trend is chiefly away from the flat or apartment of the Central Area to the growing suburbs.

Other similar reasons, most as applicable to the older suburbs as to the Central Area itself, could be cited. People move from one locality to another because they want the comfort and convenience of a new house; because a locality demands more of them than their means will allow—or probably more often because their means enable them to move to what they consider to be a more desirable district; because facilities are inadequate for their children or for business, or even because they want to be nearer public transport. For those who are looking for household comfort, privacy, independence and ownership the Central Area of Wellington as it is today has a very limited offering to make.

Some Consequences of Population Redistribution

A few observable features within the Central Area deserve some comment. For example, higher values in the Central Area frequently result in the more intensive use of land. Some of the more enterprising companies with money to invest are erecting premises with a capacity far beyond their own needs, and are offering space to smaller businesses. However, some expanding businesses are unable to find adequate office or factory space and are sometimes obliged to purchase old residences as temporary expedients, thus greatly adding to inconvenience and high overhead costs. This is a most marked characteristic of the offices of most government departments, some of which have branches and sections scattered throughout the Central Area in as many as twenty or thirty different premises—a situation which is not only a liability to the department or business concerned, but one which can prove only detrimental to the functional expansion of the city, since, because the shortage of land and premises is so acute, some industrial concerns have moved to other centres where premises are more readily available.

Housing, and particularly rental accommodation, is also affected by the shortage of land and the consequent high values. Many landlords, aware of the difficulty of obtaining suitable housing and of the advantages of a central location, charge exorbitant rentals for accommodation that is frequently below standard.

The situation in the suburbs is somewhat different. In any urban area the growing and spreading population of the new residential suburbs and settlements requires not only adequate housing but all the amenities which characterise the older-established residential areas. There are the basic requirements of water, gas, electricity and sewerage, and of access roadways, and as dwellings become occupied the need for further facilities arises—telephone connections, street lighting, footpaths, channelling and kerbing, and rubbish disposal. When the size of the local population justifies further major expenditure other amenities are established—schools, a public library, a community centre and public transport, in addition to the privately-owned shops and businesses and to institutions such as churches and societies.

In Wellington, the high cost of adequately servicing newly-settled areas is further accentuated by the irregular surface configuration of the site. Newer settlements both within, and more especially beyond, the city boundaries are not always closely adjacent to the existing built-up areas. They are often formed some distance from earlier-established settlement, with the result that suburban development is far from compact. This adds greatly to the cost of amenities and makes for less coherent development.

If decentralisation of industry and commerce in Wellington is not desirable—at present, suburban expansion within the city and into the Porirua Basin serves mostly a dormitory function—it is to be expected that the Central Area will experience further losses of population and the continued replacement of older residential areas by business premises. If, at the same time, the suburban dweller considers it is preferable to live in the outer suburbs, despite some inconveniences, then any attempt to halt the outward movement of population will have to be capable of convincing people that it is in their interests to be nearer the downtown area. In addition there must be provision in the centre of the city for adequate and attractive housing.

Transport and Traffic Problems

The perennial problem of transport and traffic congestion must also be mentioned. The mobility which permits suburban spread also brings back the suburban dweller to the centre of the city as a worker, a shopper and a pleasure-seeker. Transport, both public and private, binds city and suburb together, and its convenience and efficiency must play a major part in determining whether the city will continue to serve as a unifying core for its surrounding metropolitan region or whether the city will be utterly fragmented.

The number of commuters coming into Wellington each morning in 1957 was a little less than 20,000, and had increased by nearly seventy percent in the ten years from 1947 to 1957. Over the same period the number moving out of the city each morning (almost 4,000 in 1957) had increased by about ten percent; thus there had been a large increase in overall movement, ninety-five percent of the increase being inwards.

It is in the Central Area, where practically all the main access routes converge, that the most acute problems of congestion occur. The concentration of commercial vehicles in the Central Area moving from wharves and railway, frequently across main lines of communication, to warehouses and shops is quite as significant as the movement of private vehicles, and the inadequacy of present road capacity, routeing and traffic controls, particularly at peak periods, is self-evident. Problems of access and parking within the downtown area have been discussed at length on many occasions; a practical and adequate solution to these difficulties has yet to be found and put into practice.

Residential Density of Population

One other feature, with regard to the city as a whole, should be mentioned, namely the residential density of population. The gross density of Wellington city in 1956 was extremely low, being 6.9 persons per acre, and having declined in five years from 7.4 persons per acre. The figure for Auckland city in the same year was a little higher at 7.4 persons per acre, but by oversea standards these averages are exceedingly low. This being so, the question arises whether the best use, or even reasonable use, is being made of valuable city land. This question is highlighted by the daily invasion of the city by the thousands of motorists and other commuters. It is not that the city is incapable of absorbing daily a large proportion of the surrounding population, but that the increasing *volume of movement* during critical periods of the day is beyond the capacity of the access routes of the city. The need is for a reduction in the mass of movement by removing the motive of movement and speed—the need to get to a certain place by a certain time. That is possible either by taking employment and the major amenities to the people in the outer suburbs or by bringing many of them back permanently into the centre of the city.

One possible solution has been advocated for Wellington (and many other cities also) in an attempt to make settlement more compact, to minimise transport problems, and to reduce the costs of extended suburban growth. As envisaged, this would involve the redevelopment of considerable areas of poorer-quality housing, with vertical housing contributing much more towards the accommodation available in the Central Area. This would effectively increase the residential density of the Central Area and minimise the mass movement into the city during the day.

Yet perhaps *any* attempt to patch up the amorphous mass of our present-day cities will only seem inadequate and even inappropriate to a future generation. Changing ideals and changing needs from one generation to another demand corresponding changes in the pattern of living. It could be that the pattern of living today demands a complete revision of concepts of the form and function of a modern city.

THE WINTON DISTRICT, SOUTHLAND*

G. ROSS COCHRANE

THE WINTON district of Southland is the productive farming area focused on, and served by Winton. Covering approximately 390 square miles in area, it is situated astride the Oreti River and embraces the western flanks of the Hokonui Hills. It extends from beyond Benmore in the north to just south of Lochiel, and from Drummond in the west to the Lora Gorge and beyond Hokonui in the east. Eccentrically located in the southern third of the area, and exerting its influence over the whole district, is Winton, the only large town, the chief urban focus and the only significant centre (*Fig.* 1).

Within the Winton district a considerable variety of human use accentuates well-marked contrasts of soil, vegetation and surface relief. Differences are seen even within the major contrast between upland and lowland. Extensive pastoral farming on tussock-covered hills contrasts with prosperous intensive land use on the lowland; steep forested slopes, cutover bush, fire-blackened manuka, and peat bogs are found cheek by jowl with high-producing exotic pastures, fodder crops and high-yielding cereal crops. Within the area, especially on the productive plains, the impact of man is everywhere visible—close regular rural settlement, a good road network, small fields, neat gorse hedges, exotic shelterbelts, rich exotic grasses and crops, fat healthy livestock, drains, good farm buildings, fine homesteads, tractors and agricultural machinery. Little of the forest, tussock and extensive swamps of the original landscape remains. Much of the story of Southland[1] is recorded within the Winton district—the clearing of forests, the ploughing of tussock, the draining of swamps, man-made fertility, good pasture management, high stock-carrying capacities, the use of lime and fertilisers, efficient animal husbandry, a decline of dairying and an emphasis on fat-lamb production, problems of drainage nd flooding, lime quarrying and its bulk spreading, small rural ownships, and the economic and cultural 'pull' of the large centre of nvercargill.

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*This study, based on fieldwork carried out in May 1956 and in January 1959, does not intend to be a comprehensive geographic survey but merely indicates the outstanding geographic characteristics of the area. Acknowledgement is made to third-year students of the Department of Geography, University of Otago, who mapped the urban land use.

[1] See A. Stuart: 'Farming in New Zealand: Southland', *N.Z. Journ. Agric.*, Vol. 79, No. 2, August 1949, pp. 137-152, and H. J. Critchfield: 'Pastoral Murihiku', *N.Z. Geographer*, Vol. 7, No. 1, April 1951, pp. 1-20.

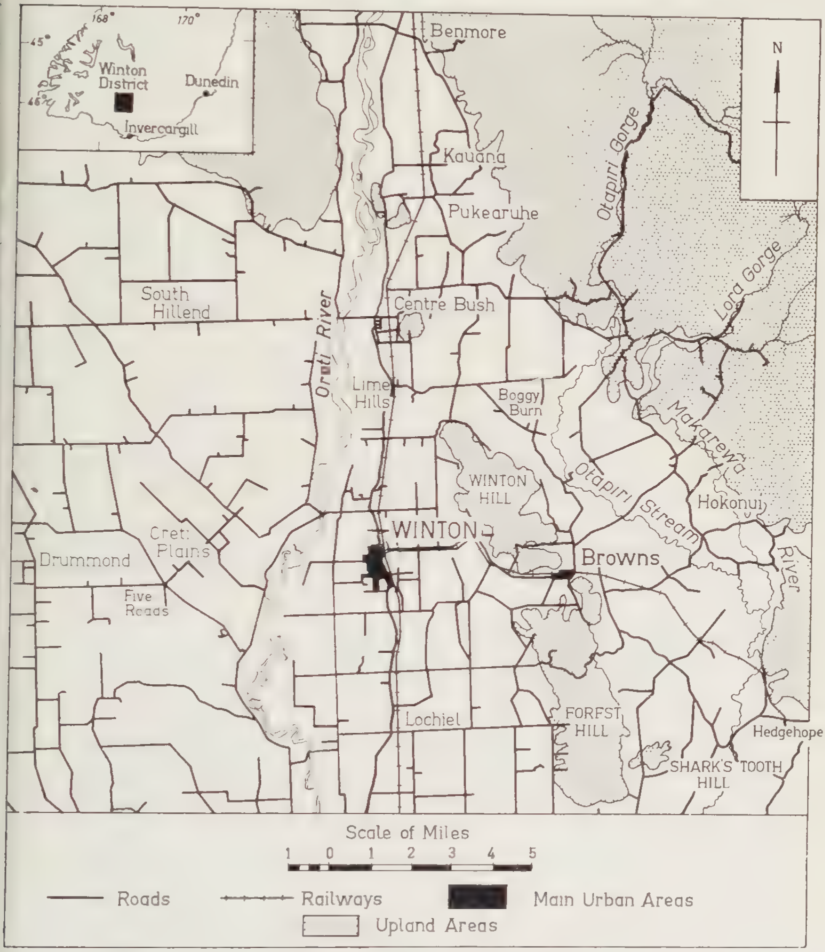

Fig. 1. The Winton district of Southland

THE PHYSICAL SETTING

Across the northern third and along the eastern margins of the Vinton district moderately steep to steep uplands rise quite sharply rom the almost featureless plains. East of Winton are several hilly utliers of the Hokonui Hills rising up to five hundred feet above the lains (*Fig.* 2). Except in the far northeast of the area, where heights f more than 2,000 feet occur, the prevailing height of the ridge crests of the Hokonui Hills is from 1,600 to 1,700 feet. Beyond the Winton district, to the northeast and east, the higher crests of this range o steeply-tilted Jurassic and Triassic rocks rise above 2,400 feet. These ranges strike northwest-southeast and the long dip slopes facing wes are moderately dissected by westward-flowing streams. Deep gorges have been carved by the larger streams such as the Otapiri and Lora The steep east-facing scarps of the Hokonui system are largely beyond the region. However these are repeated on a smaller scale in the cuesta forms of Winton Hill and Forest Hill (*Fig.* 2).

The rocks of the former Southland syncline are extensively worked for agricultural lime.[2] Nine of the thirteen major agricultural lime-works of Southland are situated in the Winton district.[3] Faulting, steep tilting and deformation, and subsequent subaerial denudation in a cool moist climate have resulted in some very steep broken country. The Bastion in the north, thirteen miles from Winton, and the rugged hill country east of Hokonui township covered mainly with bush and scrub are particularly noteworthy. Elsewhere moderate to steep slopes prevail throughout the uplands, and almost half the total area of the Winton district comprises uplands.

The Lowland

South and west of the uplands is the lowland, a small part of the much greater Southland Plain.[4] Apart from two low terraces west of the Oreti River on the Oreti-Aparima Plains, these lowlands are near-flat and almost featureless, sloping from a height of a hundred feet south of Lochiel to 350 feet in the northwest. Rising only one hundred feet in five miles, these plains are ideally suited for mechanised agriculture. Deep, largely unconsolidated, accumulations of river-deposited gravels, shingle, silts and clays of Recent age interspersed with shallow peats and deep acid bogs mask the older underlying rocks.

The Oreti River meanders over a wide shallow shingle-strewn bed. The Otapiri Stream and the Makarewa River in the east also flow across the plains in meandering courses lined with willows and scrub. As none of these rivers is deeply entrenched in the plain, flooding is a frequent and recurring problem. Earth and shingle stopbanks along sections of the left bank of the Oreti River are necessary to protect the fringing rich pastures (*Fig.* 6).

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[2] See P. G. Morgan: 'The Limestone Resources of New Zealand', *N.Z. Geol. Surv. Bull.*, Vol. 22, 1919, pp. 3-9 and 281-284.

[3] See W. Faithful: 'Importance of Lime in Southland Farming', *N.Z. Journ. Agric.*, Vol. 84, No. 3, March 1952, pp. 203-208, and L. J. King: 'The Agricultural Lime Industry of the South Island', *N.Z. Geographer*, Vol. 14, No. 2, October 1958, pp. 115-130.

[4] The Southland Plain covers an area of almost 950 square miles.

The Winton district has a cool, humid climate, and winter conditions inhibit plant growth for from four to five months. Livestock are not housed or stall fed, but graze the fodder crops. The long and numerous shelterbelts of exotic trees, however, do offer some protection to stock from the raw, biting winds of winter. Summer temperatures are mild, the January mean maximum being 67° F. as contrasted with January mean minimum of 45° F., but winter frosts are frequent. Snow may fall on seven to ten days a year. Precipitation throughout the Winton district is from thirty-two to thirty-seven inches, with a quite marked summer maximum. Although one third falls from December to February and one half in the five months from November to March, its distribution is relatively uniform and is adequate for plant growth. There are over 190 raindays annually.

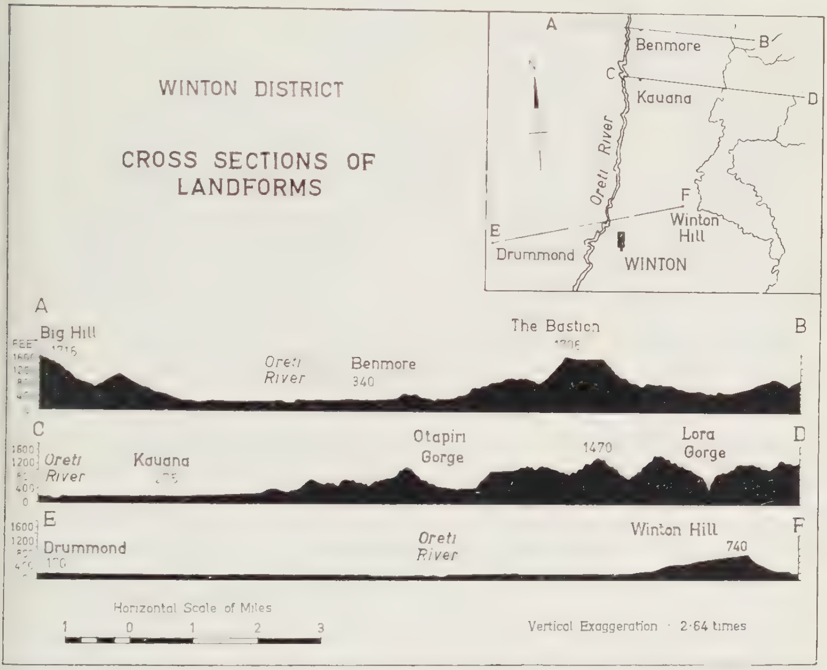

Fig. 2. Cross sections of landforms in the Winton district

Sunshine hours are slightly higher than the 1,640 recorded for Invercargill fourteen miles further south, but are low for New Zealand.

The abundant summer rainfall, the mild summer temperatures, and the prevailing cloudiness of the area give optimum conditions for the growth of lush, green clover and ryegrass pastures, and for wheat and oats, green fodder crops and root crops. In the past, red tussock (*Danthonia raouli*), swamp vegetation of raupo (*Typha angustifolia*) sedges (*Mariscus*, *Schoenus*, and *Cladium* spp.), New Zealand flax (*Phormium tenax*) and manuka (*Leptospermum scoparium*), and lowland kamaihi (*Weinmannia racemosa*) rainforest thrived under these climatic conditions despite the leached, acidic and podsolised soils.

Much of the present prosperity of the area is man-made. Since the arrival of the first agricultural settlers the felling of forest by sawmillers and farmers, the early grazing and later ploughing of tussock, the drainage of swamps, the heavy applications of lime, the good pasture management, the planting of gorse (*Ulex europaeus*) hedges and of exotic shelterbelts of *Pinus* and of species of *Eucalyptus* and *Cupressus*, and the high standard of animal husbandry have all greatly changed the indigenous vegetation (*Fig.* 3).

Because of the relative absence of rabbits and the non-acceptance of the practice of firing the tussock to bring forth new palatable shoots for the sheep to graze, tussock areas in the Winton district generally have not suffered for the worse as has been the case so often in many other tussock areas of New Zealand. Apart from exotic weed infestations in bush clearings and small areas reverting to gorse and manuka scrub, the transformation of the vegetation from indigenous to chiefly exotic over the last one hundred years has been advantageous.

The Historical Background

Development of the Winton district followed soon after the first contingent of Scottish settlers from Dunedin had landed at the Bluff in 1856. Winton, situated on slightly higher ground between the Oreti River and the fringing swamp margins, was used first as a stopover point by early drovers, and with the discovery of gold in Central Otago in the 1860's, the convenience of Winton as a stopover point between Invercargill and Lake Wakatipu was enhanced. Surveying was begun in 1863, and was followed rapidly by the establishment of a police barracks to provide escort for the gold coaches. Hotels, stores, a post office and a doctor's rooms soon followed, providing services for the large numbers of timber millers of the district. Winton also became a construction camp for many workers engaged in putting

Photo: R. G. L

Fig. 3. The lowland—a neat landscape of rectangular fields, good fences, gorse hedges, shelterbelts and numerous straight roads. Winton Hill rises abruptly from the plain in the far distances, and untidy gorse, scrub and tussock cover the hill slopes in the foreground

through a railway from Invercargill to the interior. By the end of 1863 there were more than 460 persons living at Winton.

The inducements for colonists to settle in this area of Southland were several: in particular, freedom from Maori troubles,[5] large areas of accessible cheap land, abundant easily-available timber, simple land settlement laws, and a climate similar to that of parts of England. In addition, after 1870, many miners settled and began farming. Wool production on large pastoral runs and the growing of oats, especially west of the Oreti River near Drummond, were important until the late 1880's. After this, following the subdivision of the large pastoral estates, more intensive dairy farming became important. Fat-lamb farming also developed with the more intensive use of land, and over the last two decades has superseded dairying as the most important form of agriculture in the district.

REFRIGERATION AND LIME

Much of the present prosperity of the Winton district—indeed of Southland and New Zealand generally—is directly attributable to the initiative and foresight of Thomas Brydone. Brydone, who was superintendent of the Australia and New Zealand Land Company's large Edendale estate,[6] subdivided it into smaller holdings which were ploughed, sown with English pasture grasses and used for dairying. This experiment was so successful that the first cheese factory in New Zealand was erected at Edendale in 1882. Also this momentous year saw the culmination of long efforts by Brydone when the successful refrigerated shipment of meat to England in the steamer *Dunedin* was accomplished. This opened up large new markets for dairy products as well as for meat.

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[5] This was the time of bitter conflict between Maori and pakeha in the North Island.

[6] Although outside the area, the Edendale estate, some twelve miles to the southeast of the Winton district, was the scene of developments that took place soon after, not only in the Winton district, but throughout Southland.

The successful large-scale use of agricultural lime on the Edendale estate by Brydone in 1890[7] also pioneered this important farming practice. This along with the subdivision of the larger pastoral holdings, the development of dairying, refrigeration, better transport and closer settlement resulted in a tremendous change in the landscape and the economy. Forests were felled and planted into exotic pastures; large pastoral tussock runs were subdivided, ploughed, sown with English grasses and changed to dairy farms; swamps were drained and large open drains often paralleled new roads. By the 1920's most of the lowland was intensively used. Frozen meat replaced wool as the major export, while dairy products, following the rapid spread of dairying, rivalled wool.

Many limeworks began production,[8] a tileworks, supplying field tiles to farmers to augment open ditches and mole drains, became firmly established at Browns;[9] and various factories began supplying concrete pipes, culverts and fence posts. With the rapid depletion of forests by sawmillers and farmers these last were a very real need.

LANDSCAPE AND SOILS

One hundred years of European occupance has changed markedly the former simple vegetation patterns of bush, swamp and tussock. Today a landscape rich in its diversity attests to the importance of cultural features in the geographic character of the Winton District. Intensive forms of land use are practised over half the area; only the highest and roughest areas of the uplands have not been cleared from the bush (*Figs.* 1 and 4). Yet even here a narrow fringe of pioneer farms is slowly but decisively nibbling at these last strongholds of the landscape of a century ago. On the plains several small areas of deep acid peats that are very costly and difficult to reclaim still remain as relics of the former landscape. The largest of these swamps, covering some six hundred acres, still supports a modified bush.

Except for these peat bogs and a narrow, irregular belt of coarse grasses and sedges with pockets of gorse, broom and manuka scrub and scattered willows fringing the Oreti River, the lowlands support high-quality exotic pastures of clover-rye-timothy. Sheep and dairy cattle graze and lambs are fattened on these pastures. The belt of coarse growth fringing the Oreti River and similar small areas along the Otapiri Stream and Makarewa River are subject to frequent flooding. Arable fields, used for fodder crops and cereals, are scattered throughout the lowlands, but are generally absent in the uplands (*Fig.* 5). These fields account for more than ten percent of the lowland area and add to the distinctive patchwork complexity of the rural landscape.

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[7] Successful experimental small-scale trials several years earlier in Otago gave Brydone the idea. See W. D. Hunt: 'Lime and Liming in Southland', *N.Z. Journ. Agric.*, Vol. 13, No. 2, 1916, pp. 87–96.

[8] This district produced more than one half of the output of lime in the South Island in 1945. Today the Winton district is still the most important single area of agricultural-lime production in the South Island, producing two-fifths of the total output.

[9] The tile works at Browns employ a staff of fourteen. The three kilns produce 14,000 field tiles each twice weekly, that is, a daily average production of 12,000. The tile-making machines can produce 3, 4, 5, 6 and 8-inch tiles according to the requirements. This factory cannot supply the demand by farmers for field tiles for drainage.

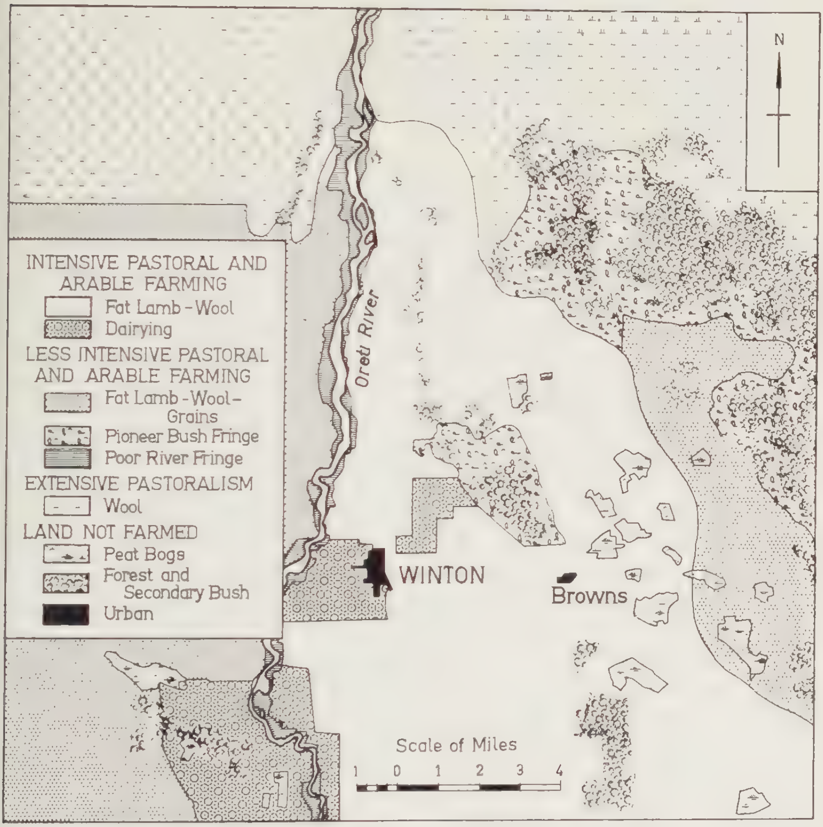

Fig. 4. Land utilisation regions of the Winton district

The extensive tussock areas in the northern uplands are superficially the least changed in the present landscape. Yet even here subtle differences in appearance and floristic composition reflect the characteristics of extensive livestock farming and a particular rural land use. The

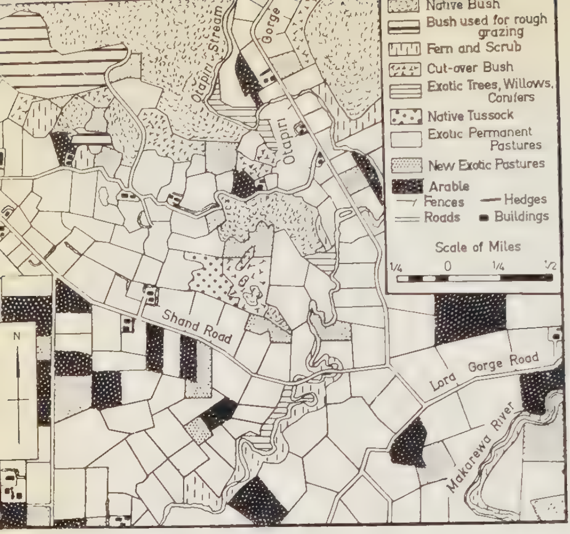

Fig. 5. Land use in the Otapiri Gorge-Shand Road area in January 1959. North of Shand Road is the pioneer bush fringe; south of the road and west of the Otapiri Stream is the orderly landscape of an intensive fat-lamb farming area; and in the southeast is the more open countryside of less intensive pastoral and arable farming areas

tussock of the uplands grows on podsolised yellow-brown clays that are less fertile than the lowland soils.

Within the lowland, areas of recent alluvial soils at East Lime Hills–Boggy Burn and south of Drummond are noted for their high fertility.[10] West of the Oreti River the clay loam topsoils overlie a gravelly subsoil, whereas east of the river the lowland soils are friable silt loams overlying a silt-clay subsoil. Consequently the soils of the Oreti Plains to the west are drier and less fertile, farms occupy greater areas, individual paddocks are larger, and the countryside generally is somewhat more open than is the case east of the Oreti River (*Fig.* 6). All soils in this area respond to lime and to phosphatic fertilisers. The peat bog soils often lack the micronutrient, copper, and light applications are necessary if pastures are to be high-producing and if livestock are to be healthy. Slight cobalt deficiencies are also present, and occasional molybdenum dressings have also been found to be beneficial for pasture growth.

PREDOMINANCE OF SHEEP FARMING

The overall importance of sheep farming is an outstanding feature of the Winton district. The predominant form of land use throughout the area is that devoted to some aspect of sheep farming, with, however, significant variations in emphasis. Variations include the production of fat lambs, of wool, of wool and store sheep, of fat lambs and dairying, of fat lambs and beef-cattle fattening, and of fat lambs and market gardening.

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[10] Oat yields of more than 100 bushels per acre and wheat yields of more than 112 bushels per acre are commonplace near Drummond. Yields of 112 bushels of oats and 136 bushels of wheat have been recorded.

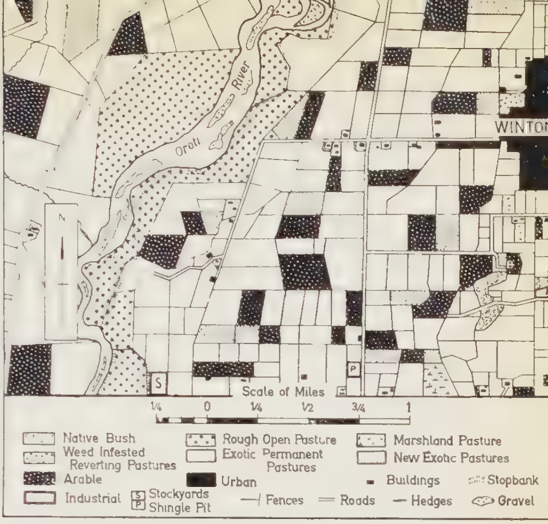

Fig. 6. Land use in the Oreti Plains–Winton area in January 1959. West of the river the open landscape and dispersed rural settlement of the less intensive fat-lamb farming area contrast with the smaller farms and fields of the dairying region adjacent to Winton. East of the river former dairy farms now rear fat lambs

Farm sizes vary from very small uneconomic farmlets of ten to twenty acres, through the high-producing 250 to 300-acre fat-lamb farms of the lowlands, to the 6,000 to 10,000-acre runs of the uplands producing fine wool. On the lowland, the sizes of farms and individual paddocks vary widely. Dairy-farm holdings are generally from forty to sixty acres, with individual fields often less than ten acres. The intensive fat-lamb farms range usually from 250 to 300 acres, with paddocks of from ten to fifteen acres. West of the Oreti River, holdings are up to 500 acres in extent, with paddock sizes from twenty to forty acres.

East of the Oreti River on the lowland, in the fat-lamb and wool region (*Fig.* 4), individual field size is generally from ten to fifteen acres. Fields are rectangular, well fenced and frequently protected by gorse hedges or taller shelterbelts. The landscape is a neat and prosperous-looking mosaic of sheep-studded fields of good exotic pastures alternating with the darker greens of fodder crops, notably turnips, swedes, choumoellier, rape, ryecorn, oats and black barley, and with the light green of new pastures, the dark browns of ploughed areas, and the golds of ripening cereal crops of wheat and oats. Throughout the area drainage systems are prominent.

The characteristic size of holding is from 250 to 300 acres, with a carrying capacity of five to six ewes to the acre. Approximately ninety percent of the farm is in permanent pasture, while the bulk of the remainder is in fodder crops. Farm income is derived chiefly from fat lambs—the progeny of Romney ewes crossed with Southdown rams. Wool is an important second source of income, and fleece weights average more than eleven pounds. Limited amounts of wheat and oats, sold to millers or for poultry food, provide yet another, though usually small, means of income. Lambing averages of 120 to 125 percent are characteristic, and averages of 135 percent are not infrequent. Lambing occurs in September, and the bulk of the lambs are sold fat from their mothers in late December or early January. The remaining lambs are fattened either for two or three weeks on new grass, or for three to four weeks on a green fodder crop such as rape, and are then sold in February.

Normally about ten percent of the farm is sown in fodder crops annually for winter feed for ewes and for fattening the second draft of lambs. Each year about five percent is sown back into new pasture. Gorse hedges are common alongside roads, but where they previously formed boundaries between fields they have often been removed and replaced by new fences using concrete posts (*Fig.* 9a).

In some years when growth is abundant and vigorous certain fields of old-established pastures are closed up for grass-seed production. This is especially the case in the Boggy Burn area of deep, rich, well-drained soils between Winton Hill and the Otapiri Stream (*Fig.* 5). Clover, timothy, rye, and cocksfoot seed are harvested in this area, and as many as twenty successive crops have been taken off, returns of 300 lbs of timothy seed per acre being common.

MECHANISATION AND TOPDRESSING

A three-year rotation of ploughing from the lea, green fodder crops, often a cereal crop, and resowing to pasture is practised throughout the lowland. Mechanisation is well advanced and many farmers own two tractors; a crawler tractor for heavy work and a lighter wheeled tractor for more general farmwork. The widespread use of many agricultural implements, which are well cared for and well housed in good implement sheds, attests to the progressive and prosperous nature of this fat-lamb farming country. The characteristic ensemble of buildings is a good and often very modern expensive farmhouse, a garage, tractor sheds, implement sheds, a woolshed, and a barn for storing hay. Not all the farms have a shearing shed, use being made of a neighbour's if necessary.

Heavy and regular applications of lime and superphosphate are necessary to maintain the productivity of the exotic pastures. Lime at the rate of one to one and a half tons per acre for the first three years, then half a ton to one ton per acre every two years after that is required to counteract the natural acidity of the soils. It is bought in bulk direct from the limeworks, and is usually spread in bulk from large trucks which drive around the paddocks distributing seven tons in as few minutes. Today more than two-thirds of the agricultural lime used in Southland is transported by road, but fourteen years ago more than sixty-five percent was transported by rail. Superphosphate is applied at the rate of from two to three hundredweight per acre annually.

Dairy Farming

Within the Winton district are three small dairying areas that are mere relics of what was once the most important type of farming in the district. These are found north of Devereux Road between Winton Hill and the outskirts of Winton, west of Winton to the Oreti River, and in the south alongside the Oreti River in the Lochiel–Spar Bush area (*Fig.* 4). All occur on lowlying land. They are not strictly or purely dairying areas, but rather are they areas where dairying is found along with the ubiquitous fat-lamb farming of the plains.

In the dairying areas west and east of Winton the land was originally subdivided into twenty-acre blocks. These are uneconomic as a single unit, and all but the poorest of the dairy farmers have at least two blocks, and generally they own three. From twenty-five to forty milking cows and from fifty to sixty ewes are carried on these farms. Immediately west of Winton, dairying, with its smaller fields, is found, but further beyond, dairying is giving way more and more to fat-lamb farming. The gradual transition from dairying to the intensive pastoralism that is so characteristic of the plains today is to be seen in the dairying areas. Almost without exception, the larger dairy farms have changed over to sheep, and only the smaller dairy farms persist. In the southern part of the dairying area west of Winton the farms carry from forty-five to seventy dairy cattle on forty to sixty acres, and often small acreages of potatoes are planted in addition to the green fodder crops grown for winter feed (*Fig.* 6).

The Lochiel–Spar Bush dairy area is characterised by larger holdings of from eighty to a hundred acres, and beef cattle are frequently found along with dairy cows and sheep. There are many marshy patches and much rough pasture in this area. Jersey cows are the predominant breed in the two northern dairying areas but Jerseys, Friesians and Shorthorns are almost equally represented in the south.

Especially in this southern area, but also to a lesser degree in the northern dairying areas, the characteristic prosperity of the lowland is lacking. Houses are poor, new houses are rare, fences and buildings are often dilapidated, while pastures are often infested with thistles, rushes and, where sheep are absent, ragwort (*Senecio jacobeum*). Frequently drainage is inadequate. Two disused dairy factories in this southern dairying area attest to the decline in dairying. Dairy production within the Winton district is not sufficient for the one remaining dairy factory, just north of Winton, which now draws from suppliers well beyond the area as a whole. This factory, with an output of 8,000 lbs of cheese annually, has just over one hundred suppliers. Production begins in September-October, reaches a peak in December-January when ten men are employed, and then falls off until April or May when the season ends. Only two men are employed throughout most of the year.

Within the rural-urban fringe of Winton is found a scattering of farmlets that are indifferently farmed by their owners. These holdings vary from two to twenty acres in size. Used for a variety of purposes, such as dairying, poultry, sheep and racehorses they are worked haphazardly on a part-time basis, and in most instances buildings are in a poor state of repair, fences are often inadequate, drains are frequently blocked or overgrown and pastures are often badly infested with weeds.

LESS INTENSIVE PASTORAL AND ARABLE FARMING

West of the Oreti River the land use on the lowland is less intensive than that found to the east (*Fig.* 4). Apart from the dairying area in the south, the landscape is more open, holdings are often larger (300 to 500 acres), fields are generally from twenty to thirty acres and up to forty acres in size, hedges are less plentiful and shelterbelts are more widely spaced (*Fig.* 6). Land use and farm management are essentially similar to those found on the plains east of the river, except that the scale is slightly less intensive, and carrying capacities over most of the area are from two to four ewes per acre. Cereal grain crops, also, are more important here, especially on the drier, lighter soils in the north. On the deep fertile soils near Drummond, sheep densities and grain yields are very high, and the chief emphasis is on fat lambs. Here, however, few lambs are sold fat from their mothers; most are fattened on fodder crops grown for the purpose.

Approximately east of the Otapiri Stream, and intermediate between the lowland and the steep slopes of the pioneer-farming fringe, is another area of less intensive mixed pastoral and arable farming (*Fig.* 4). Here on the lower hill slopes of the Hokonui Hills holdings are from 500 to 1500 acres, fields are about forty acres in size, hedges and shelter-belts are less frequent than on the plains, and more fodder crops are grown. Little grain is grown and carrying capacities are approximately three ewes to the acre. Beef cattle are also grazed and fattened, whilst lambs are fattened on green fodder crops. This area is also a reservoir for store sheep.[11]

PIONEER BUSH FRINGE

Man, in attempting to extend highly-productive intensive pastoralism from the lowlands into the uplands, has created a narrow, irregular transition area—the pioneer bush fringe (*Fig.* 4). Here elements of lowland and upland, of man and nature, of exotic and indigenous, are seen in conflict. This is an untidy landscape of steep forested slopes, of cutover bush, of standing fire-ravaged trees, of straggling temporary fences, of heaps of logs and roots awaiting firing, of tussock, of small disced areas, and of pockets of good pasture carrying sheep and beef cattle. The land use of a section of this area is shown in Figure 5. The pioneer fringe north of Shand Road contrasts strikingly with the neat landscape and the intensive land use to the south. The land, which is in 300-acre blocks, is being worked over in units of thirty to fifty acres, although fifteen-acre units are the rule in the Winton Hill pioneer fringe. The owners of these blocks receive financial aid from the government through the Marginal Lands Board.

There are several stages in the clearing of the land when the millable timber has been removed. Although kamaihi and ferns frequently survive the initial firing, stumps, logs, roots and other rubbish are bulldozed into long rows for a second burn. The area is later disced, sown with good certified pasture seed and temporarily fenced. Big trees and large stumps are left to rot. The resultant pastures vary in quality from good to poor. If there was not a good burn, tussock, sedge, bidibidi (*Acaena* spp.) and fern infestations are common. When the stumps are finally rotted the land is disced, sown to a fodder crop such as swedes or turnips and then ultimately to permanent pasture.

As yet only small areas are completely cleared (*Fig.* 8). The steeper areas, where the use of machinery is impracticable, are fired and then aerially sown with seed and topdressed with superphosphate in order to get some rough feed for livestock and also to help control erosion. Pasture 'takes' again vary enormously. Carrying capacities on most of these pioneer bush-fringe farms is only 1.5 ewes per acre, and the milling of timber from cleared areas may provide a supplementary income.

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[11] A small section of the land use of this area is shown in Figure 5—that of the southeastern part east of the Otapiri Stream.

EXTENSIVE PASTORALISM

In the uplands are large, long-established sheep stations which cover huge acreages. Here emphasis is on wool production. Green fodder crops are the exception rather than the rule, although in some places turnips are grown. Large quantities of hay are cut on lower slopes where exotic grasses have been planted after ploughing, but this is the area of extensive pastoralism based chiefly on the indigenous tussock cover (*Fig.* 4). Sheep carrying capacities are very much lower than on the more fertile plains,[12] stations breed their own replacements, but there are no fat lambs or other fat stock sold from these properties, and lambing averages are less than one hundred percent.

Careful and infrequent firing of the tussock has resulted in a good tussock cover remaining, especially in the upper Otapiri Gorge (*Fig.* 7). Runholders have left a broad strip of coarse rank growth, chiefly of snow tussock (*Danthonia flavescens*), along the crests of the Hokonui Hills, and consequently rabbits have not been able to cross over in large numbers. The good tussock cover in the uplands of the Winton district contrasts markedly with the depleted growth on the drier eastern-facing Waimea slopes of the Hokonui Hills where rabbits and too-frequent firing caused tussock depletion and erosion problems as early as the 1880's.

There has been little change in the landscape. Apart from the dark shelterbelts of pines and the small areas of exotic grasses close to the nucleus of station buildings, broad open tussock slopes and very few fences are characteristic. Over the last three decades there has been little change in farm management other than the advent of aerial topdressing and a decreased acreage of oats grown now that tractors have replaced horses for heavy farmwork. The general policy is one of slow gradual improvement of tussock pastures by aerial topdressing and aerial oversowing with clovers. On some higher, moist, shady and south-facing slopes where crawler tractors can operate, ploughing has

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[12] Sheep carrying capacity is only one to one and a half sheep per acre on the better tussock areas. On very poor areas several acres are required per sheep.

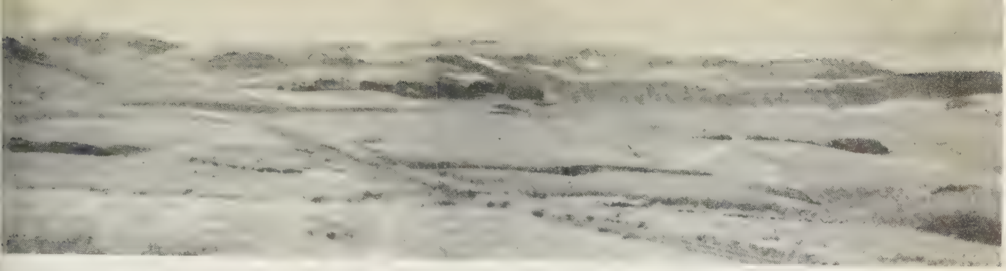

Photo: R. G. List

Fig. 7. The uplands—tussock, with some scrub and bush, dominates the landscape. In this area of the eastern Hokonui Hills extensive pastoral farming is characteristic

been extended to combat the spread of bracken fern (*Pteridium esculentum*), and on some stations Hereford steers are used to control it.

Despite the contrasts in land use and the varied landscapes within the district, the overall emphasis upon pastoralism gives a coherence to the regional variety present within this area. The emphasis on sheep farming gives a unity to plains, downlands and steep hill country.

FARMING PROBLEMS

Drainage is a major problem over most of the lowland. Major open drains throughout the area are fed by a complex system of open-ditch, field-tile and mole drains (*Fig.* 9). Mole drains are needed in some areas to break the impermeable pans that underlie some soils, whilst costly field-tile drains ramify for scores of miles throughout the better-drained lowland farms. Adequate drainage is one of the most urgent requirements for further improving farmlands and for adding to the productive area of accessible flat lands. In many areas of the plains natural drainage is poor because of the lack of gradient. This same factor makes artificial drainage costly and difficult.

The problem of providing winter feed is characteristic of the Winton district. Swedes, hard and soft turnips and choumoellier are the most common fodder crops grown. Hay is also grown in large quantities but lucerne is notably absent, largely because the roots block and disrupt field-tile drainage. Mechanisation and the use of electric fences for feeding off crops in breaks make the problem less onerous than

Fig. 8. An untidy upland landscape of bush, stumps, rotting logs and poor pastures—a pioneer fringe

formerly. Swedes are most heavily grazed just before the critical lambing period, but despite best intentions, fields are often extremely muddy and ewe losses are unavoidable. The provision of more hay and special-purpose early growing crops could overcome this problem. Crops for fattening feed—kale, rape and ryecorn—must also be grown for the lambs.

Although productivity of this area is high, the high cost of fencing[13] is another problem that is keeping productivity below the maximum possible. Experiments on the Agricultural Research Farm near Winton have shown that sheep carrying capacity can be doubled if farms are further subdivided into much smaller paddocks and a very strict rotational grazing programme is adopted. On properties near the rivers flooding is a constant and unpredictable problem that is only partially controlled by the stopbanks that have been constructed.

The high natural acidity of the soils must be counteracted by liming to achieve good pasture growth. In addition, acidophyllous fungi that ruin swede crops (clubroot disease) can be controlled in these soils only by the continued use of lime, and without it disastrous losses to root crops would result, thus crippling the present economy of this prosperous farming area of southern New Zealand.

COMMUNICATIONS

Reflecting major contrasts in relief and land use within the Winton district are two distinct communication patterns: that of the lowland and that characteristic of the upland. On the lowland numerous straight roads in a rectangular grid pattern ensure easy and rapid communications between areas, and also aid the efficient and speedy distribution of lime, livestock, hay and other farming produce. Both the main road and the main railway from Invercargill to Kingston pass through Winton, so that most north-south traffic between these places passes through the town, and much of this road traffic brings custom to Winton. A branch railway line from Winton through Browns to Hedgehope serves the eastern part of the district.

On the lowland, east-west communications are good both to the west and to the east of the Oreti River. Links between, however, are poor because of the physical obstacle of the river. The difficulties of bridging the gravel bed of the river have limited west-east crossing points to only four; elsewhere the west-east roads terminate at the river.

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[13] New fencing on the plains costs £600 per mile. In the less accessible areas costs are even higher.

Fig. 9a. Field tiles. A new wire fence has replaced the gorse hedge, now to be burned

Fig. 9b. Deep open drains as major water channels

Fig. 9c. Field tiles and local drains in damp areas

Fig. 9d. Mole drains to counteract waterlogging in soils developing hard pans

In the uplands, roads follow valleys, and in most cases are merely access roads to scattered hill farms, and pastoral runs. In contradistinction to the numerous straight roads of the plains these roads twist and wind and are few in number. However, since its completion more than three years ago, the hill-country road from Otapiri Gorge eastwards through the Hokonui Hills to Mandeville and Gore has formed an important link between the Southland and Waimea Plains.

Within the Winton district there are clearly defined differences in communication and settlement patterns. Nowhere in the rural areas is population density high, but settlement is notably much closer and more evenly distributed on the lowland than is the case in the uplands. The well-spaced linear settlement pattern of the plains is closely aligned to the road pattern, yet even here the area west of the Oreti River is less densely settled that that to the east.

SETTLEMENT

Settlement is more closely spaced in the dairying areas than in the intensive fat-lamb farming areas, but buildings are generally less prosperous and less well cared for. Outside the lowland there is only sparse settlement. In the pioneer-farming fringe the settlement becomes much more haphazard. In the remaining areas of the uplands, settlement is extremely dispersed, is of a very low density, and is confined to the few widely-spaced homesteads on sheep stations.

There is little urban settlement. With the clearing of the forests, the draining of the swamps and the opening of the Invercargill–Kingston railway, the strategic economic position of Winton allowed it to supply most of the needs of the area as a whole, and so it alone grew. The small townships occur at road junctions, or along the main north-south road, or near limeworks. In form most are irregular, though Centre Bush and Drummond are nucleated. Browns, very much smaller than Winton, is the only other urban centre of any note. Shoestring settlement characterises this township. Aligned along the Winton–Browns road, the western half of the township is focused on the limeworks, the eastern half serves the tileworks.

The numerous small rural townships cater for immediate local needs; Winton is looked to for other than daily requirements. For most business and commerce, for professional services, and for many social and recreational activities, Winton serves the needs of the townspeople, the local farmers and those employed in the tileworks, limeworks and the Awarua dairy factory. The preparation of agricultural lime is, in several instances, another important function of these rural townships. In some cases—Lime Hills, Centre Bush and Lady Barkly—this processing of agricultural lime is the *raison d'être* of such townships.

Limeworks, together employing more than eighty persons, are found at Browns, Winton Hill, Lady Barkly, Fernhill, Forest Hill, Sharks Tooth Hill and Centre Bush. Not all these limeworks are adjacent to small townships. Located on hills of Tertiary limestone largely to the east of Winton, the limeworks are strategically sited near railway lines or good roads in order to facilitate disposal to both the local farmers and to markets outside the district.

WINTON: FORM AND FUNCTION

Winton is almost centrally situated on the lowlands, but it is set in the southern third of the Winton district. This prosperous, attractive town, with its parks and belts of English trees, serves a rich farming community. The town is roughly rectangular in plan, being one and a half miles from north to south and up to three-quarters of a mile wide. Its site is more than a mile east of the Oreti River on ground that is slightly higher than the surrounding area. East of the borough boundary there is quite a sharp drop of several feet to the plains. This low-lying area east of the Invercargill–Kingston railway has been avoided because of its marshy nature, and consequently Winton is asymmetrically elongated along the North Road and to the west. Ninety percent of the town is west of the railway and the main north-south road.

The form and generalised land use of Winton are shown in Figure 10. Residential land occupies the greatest area. Between Grange Street to the north and Eglington Street to the south, and to the west of North Road and its fringing commercial zone, there is a fairly compact residential block. To the north and to the south of this, residential land is less dense with much open land between. To the east of North Road residential land is scattered and is not very important.

Although most of the new building of homes is taking place outside the central residential block and nearer the extremities of town, this is also the area where the boundary between town and country is least sharp, for, except in the east there is no distinct demarcation between Winton and the adjacent rural areas. Throughout the town the majority of the older houses are small, wooden and of one storey. The newer houses of the postwar period are generally large, attractive and are built of brick or of brick and plaster rather than of timber.

There is a semblance of a commercial core between Brandon and Bute Streets near the north-south centre of town, but the attenuated form of Winton has resulted in land used for commercial and professional purposes extending a further twenty-five chains along North Road. The North Road is the most important road in the town, containing as it does the majority of the business premises, including branches of numerous stock and station agents. Smaller isolated commercial areas occur to the north, but the large commercial area occupied by the Winton saleyards is found in the south near the main road. The town has a high proportion of its workforce employed in the retail trade, but for large drapery items, books and furniture the people of the Winton district usually buy from the wider ranges offered at Invercargill. The market hinterland of Winton is in fact constricted in the south by the dominating influence of Invercargill.

Influence of Invercargill

Despite its prosperity there are limited employment opportunities for young people within Winton. Clerical and professional openings are especially restricted. Labouring and contract work are available in the recently-established concrete products factories, in the numerous garages, and in a small clothing factory, the newer industries occupying the former vacant areas on the east side of North Road. Other industries include a sawmill and a small winery that is interesting rather than important. Winton has seven repair and servicing garages as well as a panelbeater and a tractor and agricultural-machinery repair shop. Here again, however, the influence of Invercargill is felt in that by far the greatest proportion of business comes from the northeast and north, while very little comes from the south. Many of the younger people of Winton commute daily to Invercargill, whilst others board in the city and return to Winton each weekend.

Winton caters adequately for its present recreational, social and educational needs. Both secular and church schools are present, and the manual section of the Winton District High School, in addition to serving the whole Winton district, caters for many other schools as far afield as Mossburn. Four churches, three schools and a small maternity hospital serve the needs of 1,500 people in Winton and its immediate surroundings.

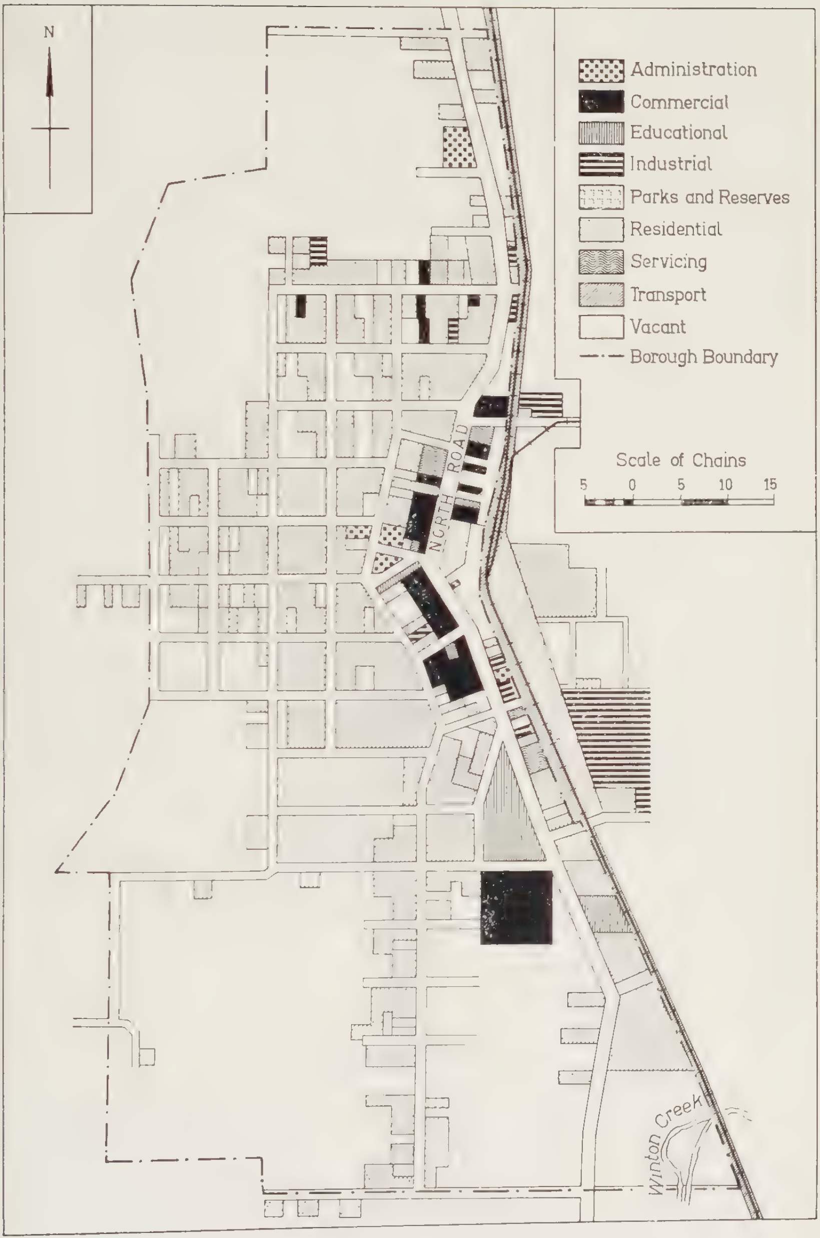

Fig. 10. Urban land use in the borough of Winton, May 1956

Transport is a vital and integral part of the internal prosperity of the region and for outside contacts. Railway transport is important for the movement of goods, but road transport is favoured for passenger traffic. Six pick-up freight trains pass through Winton daily, and the recently-improved branch to Browns carries lime, field tiles and coal. Inward rail freight consists of stock, iron, cement, fertilisers, coal and general goods, whilst that outwards comprises stock, lime, concrete products, field tiles and agricultural machinery. The long narrow transport area associated with the Winton railway yards, and two small areas in the town used by road transport, are the only land used purely for transport in Winton. Road transport is becoming increasingly competitive to rail in the movement of stock and lime. The greater mobility of road transport reduces both costs and time; it often involves less handling, and in the case of livestock it usually results in a minimum of damage.

In spite of the attraction of Invercargill, Winton has many functions which are vital to both the urban dweller and the farming community. It functions as a residential centre for those employed in the administrative, transport and commercial activities of the town; it is an administrative and commercial centre for a wide area, and within the town some industries are found that bear a close relationship with the rural landscape. As a market centre for livestock it is important both within and beyond the Winton district. In addition, Winton provides hospital, educational, religious and recreational amenities. Its importance was shown early in the development of the district, and the town has maintained and even increased its influence as the surrounding countryside has developed, although it will never escape the partial dominance of Invercargill.

Conclusion

The Winton district is characterised by its distinctive regional variety. Different farm practices occur in response to variations in relief, microclimate and soil fertility, but on the whole the economy of the area is focused on sheep farming, which, both for meat and for wool, is the basis of the prosperity of the area. Within the district nine distinctive types of land use are found, and twelve easily-distinguishable areas, each with its own distinctive character, together make up the varied landscape of the district. All this area is served by Winton, which, long with the emphasis on sheep farming, contributes to the unity of he district and imparts a wholeness to the several distinctive regions.

The Winton district is an area where a high standard of farming has been attained. Farming problems are being tackled in an enlightened manner. Better techniques and the right incentives could substantially ncrease the already high productivity of this area.[14] The lowland is epresentative of the best fat-lamb country in Southland—indeed in New Zealand. Any increased productivity of this area will be paralleled by the continued urban development of Winton itself.

The Winton district today reflects much of its history. Forested upland, small areas of undrained swamps, and the transitional pioneer-farming fringe contrast with the neat prosperity of a largely man-made farming landscape. The mature landscape of the lowland reflects man's ability—in particular his skilful pasture management and high standard of animal husbandry that have converted former forest, tussock and wamp into the fertile productive region where progress and prosperity are reflected in the landscape.

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[1] See S. H. Saxby and W. Faithful: 'Developing Ploughable Tussock Grassland in Southland', *N.Z. Journ. Agric.*, Vol. 85, No. 1, July 1952, pp. 46–54; and A. Stuart: 'Development of Browntop Country in the South Island', *ibid.*, Vol. 86, No. 2, February 1953, pp. 155–163.

CHANGING PATTERNS OF SETTLEMENT IN TAURANGA COUNTY

EVELYN DINSDALE

THE SHORES of Tauranga Harbour and the Maketu distric have been continuously occupied since some time in the twelft century A.D. but the patterns of human settlement have varied greatl over this period, particularly during the one hundred and thirty year that have followed the arrival of permanent European settlers. Th history of settlement in Tauranga county can be divided into thre periods: first, Maori settlement, characterised by fortified villages usually near the sea, with small garden plots communally owned an cultivated nearby; second, superimposed on this pattern after 18 were the mission stations at Otumoetai, Tauranga and Maketu an the establishments of several European traders associated with Ma villages along the coast; and third, the period of permanent Europea settlement. This last began with the establishment of a military settlement at Tauranga in 1864, and was followed by the founding o the Stewart special settlements at Katikati and Te Puke in the 1870' and the gradual conversion of large areas of fern land into productiv farms.

Evidence of these different periods of human endeavour still remain on the landscape of Tauranga country in the form of Maori earthworks, European redoubts, deserted bush camps and gold workings and early colonial-style houses. Today, although forest remains on th highest ranges, the county has been transformed into a complex pattern of pasture, field crops and orchards; farmhouses, shelterbelt and fences; roads and railways; and is served by the two market town and service centres of Katikati and Te Puke and the larger urban are of Tauranga and Mount Maunganui, the growing port and commercia centre.

MAORI SETTLEMENT

The lowland areas, bounded in the north by the sea and to the south by forest-covered ranges rising to more than 1,500 feet, were partiularly favourable for the settlement of a fairly large Maori population. The soils were suitable for the cultivation of kumara and other crops; he harbour at Tauranga and the lagoons at Maketu provided safe nchorage; the coastal areas of harbour and ocean provided an abundnce of shellfish, sea eggs and crayfish; and the rivers, harbour, lagoons and open ocean were the source of a great variety of fish. Nearby was the forest to supplement the diet with fruit and birds and to supply timber for canoes and houses.

According to tradition, when Kupe visited New Zealand in the tenth century A.D. he found the country uninhabited. None of his crew

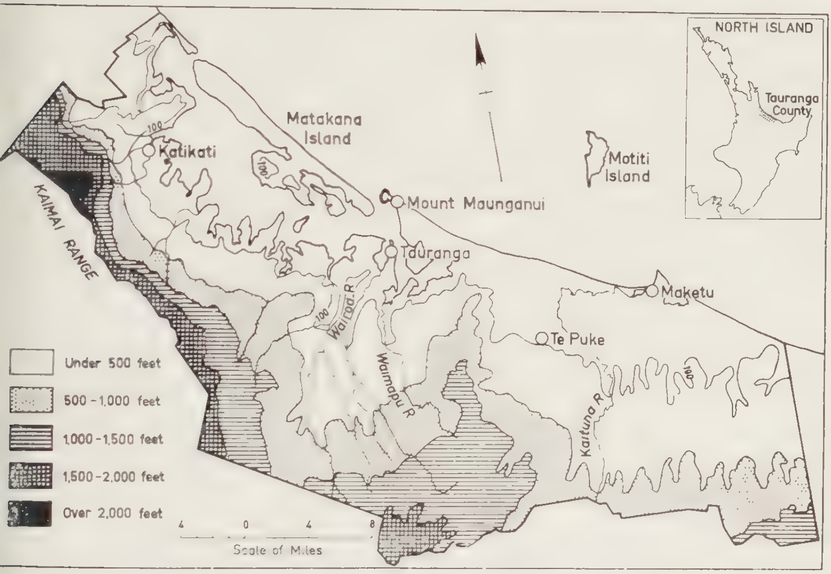

Fig. 1. Tauranga county: place names and physical features

ettled in New Zealand, but particulars of the land and sailing directions ere handed down by oral tradition.[1] Sometime between the tenth nd twelfth centuries the first settlers arrived in the Bay of Plenty, but radition and opinions as to who they were and what they were like ary. Gudgeon says there were two aboriginal tribes: the *turehu* airies), possibly a fair-haired Polynesian strain, who were conquered y the later arrivals, the Moriori.[2] Best describes one wave of people, e Maruiwi, who landed on the Taranaki coast near Urenui, and, as

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. Best: 'Maori Voyagers and their Vessels', *Trans. N.Z. Inst.*, Vol. 48, 1915, p. 447.
. E. Gudgeon: 'Maori Tribes of the East Coast of New Zealand', *Journ. Polynes. Soc.*, Vol. 3, 894, p. 208.

numbers increased spread over the rest of Taranaki to Tamaki, the Bay of Plenty and Hawkes Bay. He suggests they came from Fiji or the New Hebrides because, first, their canoes drifted from a west to northwesterly direction, second, the North Island forts are similar to those in Fiji, and therefore the Maruiwi had the art and taught later settlers, and, third, cannibalism occurred in the North Island and in Fiji.[3]

MAORI TRADITION

Best[4] quotes Te Matorohanga's description to support this theory. This was a traditional account of the aboriginal people, an ill-favoured folk, dark-skinned, ugly, tall and spare with flat faces, flat noses, upturned nostrils and projecting eyebrows, and with hair that stood out or was bushy. They lived in rude huts and wore no garments except leaves and roughly-woven capes in winter. Their diet consisted of fish and products of the forest, and there was no preserving of food. Although this probably represented a people in an earlier stage of development—a nomadic, subsistence hunting, fishing and gathering economy—it is a Maori description of a people the Maori had conquered and therefore probably disparaging and uncomplimentary. It is not necessarily a justification for saying the aboriginal people were Melanesian. More likely, they were an earlier wave of Polynesian migrants, for the Bay of Plenty was the first landing place of many Polynesian settlers.

Adkin[5] defines four separate waves: two waves of Waitaha tribes who later migrated to Southland; Ngatimamoe, who also migrated to the South Island; and the Hawaiki Maori who arrived c. 1350. Shand[6] notes a tradition that the original New Zealand home of the Moriori of the Chatham Islands was between Tauranga and Maketu. Duff[7] considers that there were only two waves of Polynesian immigrants: Moa Hunters and 'Fleet' Maori. In spite of Best's work, evidence seems to indicate that all these earliest settlers in Tauranga county were Polynesian and practised a subsistence hunting, gathering and fishing economy.

Toi reached the Bay of Plenty in the twelfth century and is said

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[3] Best: *loc. cit.*

[4] *idem*: 'The Land of Tara', *Journ. Polynes. Soc.*, Vol. 26, 1917, p. 143.

[5] G. L. Adkin: 'Geological Evidence of the Antiquity of Man in New Zealand', *N.Z. Sci. Rev.*, 10 April 1952, p. 41.

[6] A. Shand: 'Early History of the Morioris', *Trans. N.Z. Inst.*, Vol. 37, 1904, p. 144.

[7] R. Duff: *The Moa-Hunter Period of Maori Culture*, Wellington, 1956.

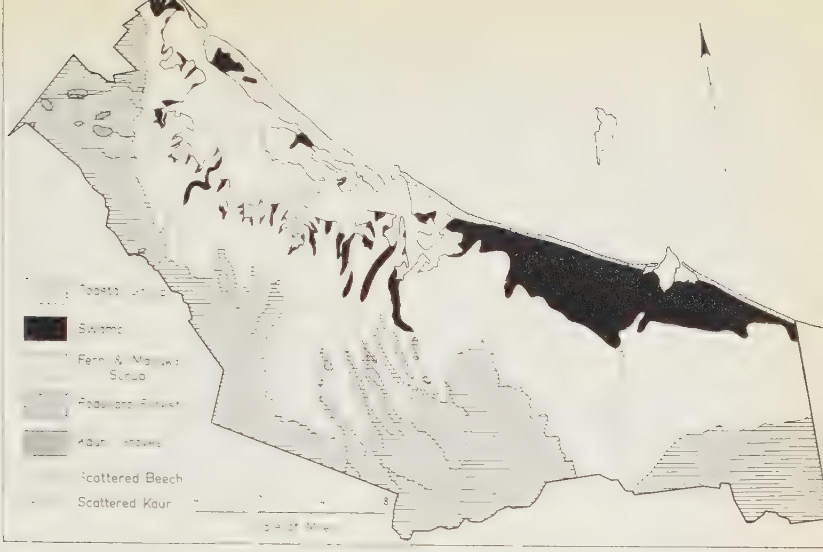

Fig. 2. The vegetation of Tauranga county c. 1820

to have introduced the kumara into the aboriginal diet.[8] Several other canoes, distinct from the migration in 1350, are mentioned in traditions as having brought food and textile plants: *aute* (paper mulberry), *ti* (cabbage tree), taro and *hue* (gourd).[9] Whether these introduced plants were specially cultivated or collected as they grew wild is not known, but very likely rudimentary cultivation of food crops to supplement the products of the forest and sea began about this time. Moa still survived and formed part of the food supply: Toi's brother-in-law is said to have killed five inland of Maketu.[10]

LATER MAORI SETTLERS

About the time of the Hawaiki ('Fleet') Maori arrival in approximately 1350 A.D., the coastal areas around Tauranga Harbour were fairly densely populated by the aboriginal Ngamarama, Purukapenga and Waitaha tribes. The *Tainui* canoe is said to have called and left some settlers at Katikati.[11] In some traditions, *Arawa* is said to have reached Tauranga Harbour, found settlers at Katikati, left a few people at Maunganui and continued on to Maketu which must have been uninhabited at the time as the Arawa chiefs proceeded to stake out land claims for themselves.[12] Later, some of the Arawa people moved to

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[8] Whatahoro: 'Te Kauwae Raro', *Journ. Polynes. Soc.*, Vol. 22, 1913, p. 200 (translation by S. Percy Smith).

[9] E. Best: 'Notes on Ancient Polynesian Migrants', *Trans. N.Z. Inst.*, Vol. 37, 1904, p. 121.

[10] *idem*: 'The Maori and the Moa', *Journ. Polynes. Soc.*, Vol. 20, 1911, pp. 54-59.

[11] E. Shortland: 'A Short Sketch of the Maori Races', *Trans. N.Z. Inst.*, Vol. 1, 1868, pp. 329-338.

[12] Shortland: *op. cit.*

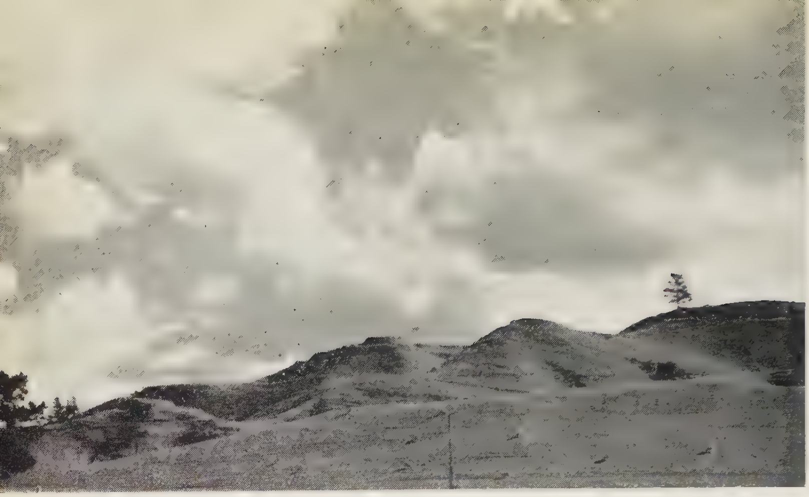

Photo: A. D. Epstein

Fig. 3. Terraced hills at Papamoa, near Te Puke. Remnants of a former large and strongly fortified village overlooking the coastal lowlands in the foreground where the people of the village cultivated their crops

the Rotorua district. The *Takitimu* also called on its way southwards along the east coast and left a few people, including the chief Tamate who built his pa at Mangatawa[13]. There is a tradition that this sam Tamatea ordered the forest to be burned in order to get rid of *ngarar* (reptile monsters) and in the process the moa was destroyed.[14] This would account for the large area of fern land with forest surviving only in the deeper gullies. Kahikatea logs have also been found in the swamps near Maketu (*Fig.* 2).

As population increased, competition for food supplies became keener. War developed along with the complicated procedure of *utu* and tribal loyalties. Elaborate fortified villages, with earthworks and pallisades, situated in commanding positions on hills and promontories with the communal cultivations nearby, became the dominant feature of the settlement pattern of the area in contrast to the less permanent 'camps' of the earlier period. Captain Cook in 1760 described the eastern portion of the Bay of Plenty, which was probably typical also of the coastal areas of Tauranga county, as 'of a moderate height and all a level flat country, pretty clear of wood and full of plantations and villages. These villages are built on eminences near the sea and are fortified on the land side with a bank and ditch and pallisaded all round. Besides this some of them appeared to have outworks . . . '.[15]

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[13] J. H. Mitchell: *Takitimu*, Wellington, 1944, p. 41.

[14] Best: 'The Maori and the Moa', *op. cit.*

[15] Capt. W. J. L. Wharton (Ed.): *Captain Cook's Journal during his First Voyage around the World in H.M. Bark 'Endeavour', 1768–1771*, London, 1893.

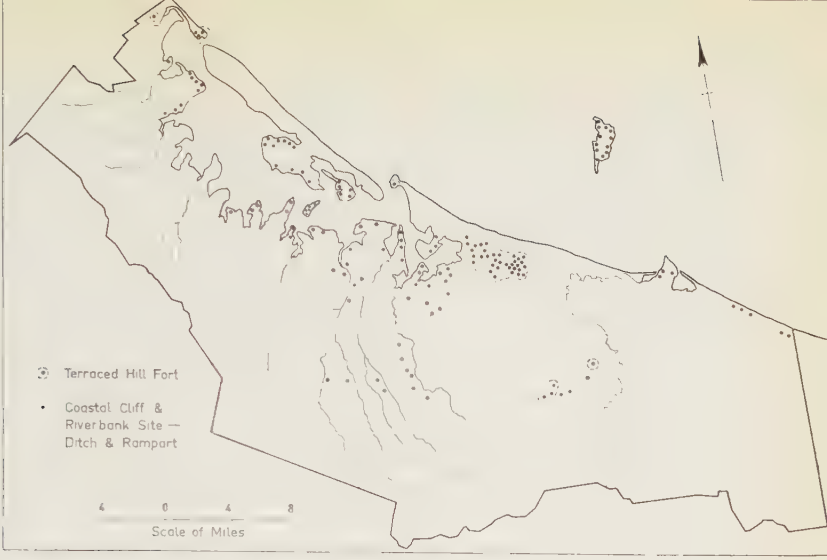

Fig. 4. Maori earthworks in Tauranga county

Three types of fortified villages were evolved during this period: hill forts with terraced hill tops and pallisades—the largest and most complex: coastal-cliff and riverbank forts usually with a single ditch and bank and pallisades—smaller pa often associated with the cultivations, and occupied during planting and harvesting (*Fig.* 4); and forest-margin settlements with pallisades but no earthworks—retreats when hard pressed by an enemy.

Wars meant that the population was still migratory to some extent, for when a village was overrun by a neighbouring *hapu*, or tribe, the inhabitants were either taken into slavery by the victors or fled elsewhere to rebuild their village. The conquerors not infrequently took over the original site. This pattern of migration caused by war occurred more than once in Tauranga county. About 1530 the Ngatiranginui migrated from Hangaroa, in Hawkes Bay, and settled on the coastlands of Tauranga Harbour. The conquered Ngamarama fled inland to Te Irihanga. The Ngatiranginui lived comparatively undisturbed until about 1650, when Ngaiterangi, expelled from their East Coast home sought a place to settle along the Bay of Plenty coast. They defeated the Arawa at Maketu and lived there for some time before taking possession of the large Maunganui pa, held jointly by Ngatiranginui and Waitaha. The Waitaha fled southwards; but the Ngatiranginui built new villages inland along the forest margin while Ngaiterangi extended control over the coastlands[16] (*Fig.* 5).

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[16] See J. A. Wilson: *Sketches of Ancient Maori Life and History*, Auckland, 1906, for an account of battles between the Ngaiterangi and Ngatiranginui.

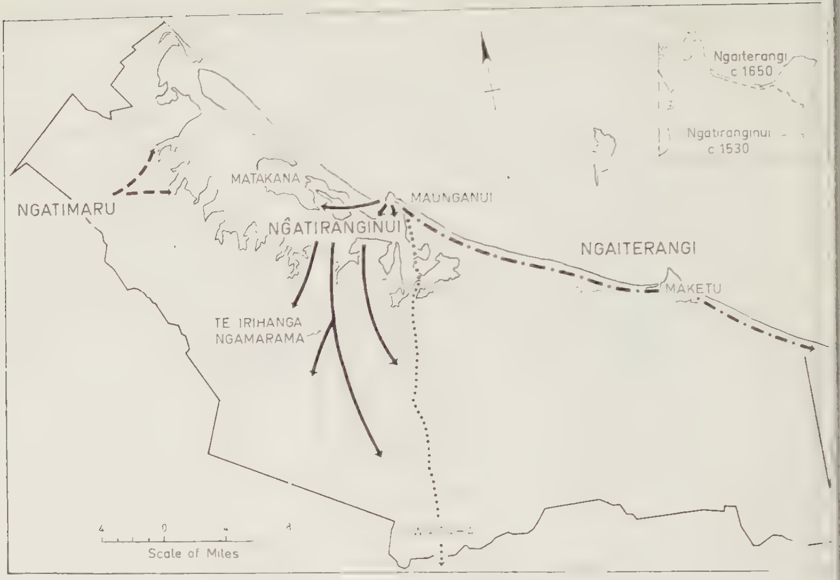

Fig. 5. Maori incursions and spread of settlement, 1500 to 1700

In 1826, when the mission schooner *Herald* first visited Taurang the three main centres of population were at Otumoetai, Te Papa an Maungatapu, but by 1828 Te Papa had been destroyed by Ngatimar of the Thames Valley, and most of the inhabitants had been kille The missionary J. A. Wilson estimated a population of about 2,00 around Tauranga Harbour in 1828. Maketu was an important centr and seaport for the Arawa, but it was deserted periodically accordin to the fortunes of war between Arawa and Ngaiterangi.

Missionaries, Traders and Maoris

After 1800 European whalers and sealers frequently called at th Bay of Islands to obtain water and supplies of pigs and potatoes. Soo after them came the traders to load kauri and flax. Many deserter adventurers and escaped convicts had settled in Maori villages in Nort Auckland as pakeha Maori traders, and by the 1830's were beginning t extend their activities further afield into the Bay of Plenty, Rotoru and Waikato areas. In 1814 Marsden had preached his first sermon i New Zealand and soon afterwards mission stations of several differen denominations were established throughout the North Acklan Peninsula. By the late 1820's the Church Missionary Society w planning to extend its work further south, and during the 1830's stations were established in the Waikato and Thames Valley, and around Rotorua and the Bay of Plenty—in 1835 at Te Papa and in 1840 at Maketu. These were soon followed by other denominations, particularly the Roman Catholics who established two stations at Otumoetai and Maketu between 1840 and 1842.

The Ngapuhi of North Auckland were the first tribe to obtain firearms which they used to great effect in numerous raids on the tribes further south. In addition other tribal wars were waged against neighbouring peoples; the Ngaiterangi allied with the Waikato against both the Ngatimaru of the Thames Valley and the Arawa of Rotorua and Maketu. Consequently the first European visitors to Tauranga county were not unnaturally welcomed for their material wealth, particularly if this took the form of muskets and powder, and it must have been very confusing for the Maori inhabitants to find that there were different kinds of Europeans. There were the traders who exchanged muskets, powder, rum, blankets and other merchandise in small quantities for large amounts of scraped flax, pigs and potatoes. There were the missionaries who were not interested in trading and who condemned the activities of the traders but brought a new kind of religion in all its nineteenth-century narrowness to upset the ancient beliefs and to undermine the *mana* of chief and *tohunga*. Then, to confuse the issue still further, there were two kinds of missionaries, those of the Church Missionary Society, who were Anglicans, and those of the Roman Catholic faith, each group bitterly opposed to the other and both proclaiming that theirs was the one true religion.

SIGNIFICANCE OF PAKEHA CONTACTS

European settlement during this period consisted of a number of mission and trading stations scattered along the coast, especially around the eastern portion of Tauranga Harbour (*Fig.* 6). Whereas the missionary maintained his own self-contained settlement, the trader usually allied himself with a Maori village, lived there as a pakeha Maori and took a Maori wife. Probably the most distinctive feature of this period is the influence which a handful of European settlers was to have on Maori life, economy and settlement patterns. One trader, Tapsell, caused whole villages to migrate to Maketu and spend long hours scraping flax in the swamps while cultivations were neglected.

The consequent deficiency in diet was only partially compensated b the supplies of flour and sugar received as payment, though mos eagerly sought after were muskets and powder.[17]

Early trade was by barter and was controlled by pakeha Maor traders who supplied flax to Sydney firms and food supplies for th Bay of Islands market. By 1840 an increasing market in the growin town of Auckland became available and trade became more organised Many Maoris were now concentrating on growing commercial crop of wheat and potatoes and using the money obtained from their sal to buy European food, drink and clothing. Many young men wer going to Auckland to work for wages while others were building thei own ships and trading on their own account, gradually becomin accustomed to a money economy.[18]

Although missionary work wrought profound psychological an social changes in Maori life, the impact of the traders was of muc greater significance. Certainly, missionary influence did more to stam out cannibalism and to replace the ancient custom of *utu* by mor peaceable methods of settling disputes. The chivalrous manner in whi the battle at Gate Pa was conducted in 1864 was the result of thir years of missionary teaching. Nevertheless, it was the trader wh unconsciously did most to effect the change from the pre-Europea communal subsistence economy to one where money was the importan factor. He introduced trade in the European sense of the term, but b 1860 the transition was by no means complete. The reconciling of th old cooperative communal way of life with the individual enterpris expected by the European was only just beginning to raise suc problems as the communal tenure of lands, ships and goods where al are owners but no one person is responsible.[19] These problems require solution if the Maori was to compete with the European in commerc and obtain the material benefits offered by the European.

Not all European influences, habits and material goods were to th advantage of the Maori. The intertribal wars fought with Europea firearms with a high mortality rate which characterised the earlier par of the period were brought to an uneasy peace in 1845, and althoug warfare became less frequent, introduced European diseases such a

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[17] See E. Tapsell: *Historic Maketu*, Rotorua, 1940; and J. Cowan: *A Trader in Cannibal Lan* Dunedin, 1935.

[18] Transcript of the Rev. A. N. Brown's journal, 1835-1846; entries for 8 July 1846, 22 Septembe 1846 and 17 June 1847 (typescript in Turnbull Library, Wellington).

[19] F. von Hochstetter: *New Zealand; Physical Geography, Geology and Natural History*, Stuttgar 1867, p. 218.

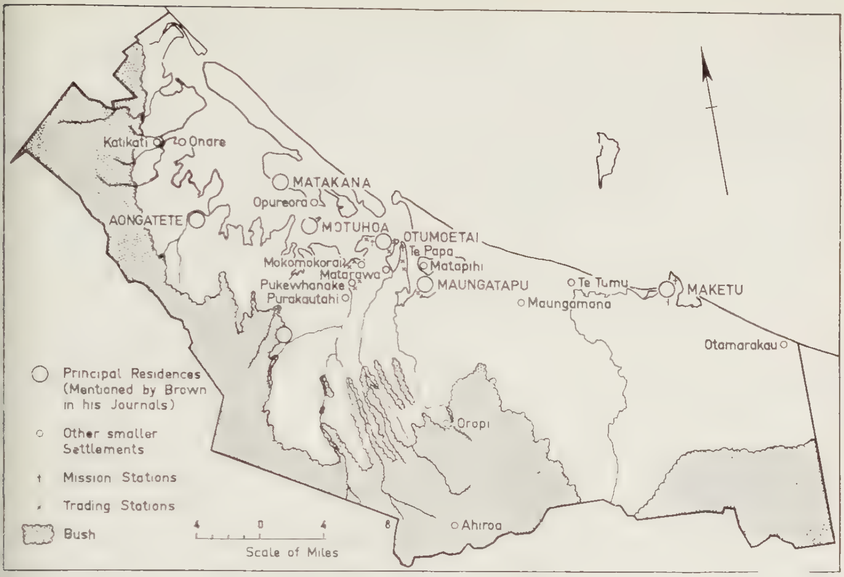

Fig. 6. Maori villages, missions and trading stations c. 1840. Little information concerning Tauranga county is available, and Maori villages—'principal residences' and otherwise—have been mapped from incidental references made by Archdeacon Brown. Nowhere does Brown furnish a complete list

influenza, measles, typhoid and tuberculosis continued to take their toll. Epidemics were frequent and usually fatal, aggravated as they were by lack of sanitation and poor living and working conditions.[20] The Maori population of Tauranga county was, as in many other North Island districts, declining, and already some observers were predicting the extinction of the race within the forseeable future.[21]

MILITARY SETTLEMENT

The Waikato War began in 1859, and in January 1864 imperial troops were landed at Tauranga. Although some Ngaiterangi were actively assisting the Waikato on the strength of an alliance made in the 1840's, there was no suggestion of active hostility by the Ngaiterangi at Tauranga. The landing of troops at Te Papa, the peninsula where the town of Tauranga is now situated, seems to have been largely a precautionary measure and, it is suspected, not unconnected with plans for subsequent European settlement in the district. The Ngaiterangi, suspicious of the motives of the government and tiring of inactio with so many government troops about, proposed a battle at Gate P and drew up a list of rules for it. The Maoris won the day in th encounter on 29 April 1864, but this was soon avenged when government troops caught the Ngaiterangi unprepared at Te Ranga soo after. Apart from one incident at Maketu, and some skirmishes with small band of Hau Hau rebels in the forest of the Kaimai Ranges, ther was no other active fighting in Tauranga county.

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[20] Transcript of the Rev. A. N. Brown's journal, *op. cit.*, entries for 4 January 1837, 2 August 1838, 13 January 1839 and 2 May 1840.

[21] J. C. Bidwill: *Rambles in New Zealand*, London, 1841, p. 29; and Hochstetter: *op. cit.*, p. 443.

Nevertheless, 214,000 acres were confiscated from the Ngaiterang under the New Zealand Settlements Act, 1863, which authorised th confiscation of land from tribes which had taken up arms against th government. This land was to be used for military settlements as pa of Governor Grey's scheme to establish a belt extending from Ragla to Tauranga to protect Auckland from incursions by Maori tribes the south.[22] Of this block, 50,000 acres were eventually retained f military settlement by the First Regiment of Waikato Militia, th remainder being returned to the Ngaiterangi (*Fig.* 7). On 24 Ma 1864 300 militiamen were left to form a military settlement at Taura which then consisted of two redoubts, Monmouth and Durham, a fe wooden buildings, and a conglomeration of tents and wood, sod thatch huts set amongst the fern along the waterfront.[23]

Each military settler was given a quarter-acre town section and fifty-acre farm block. Some built on their town sections and the struggled to break in their farms, but found themselves beset with man difficulties. Many had no farming experience; access to the farm often isolated by swamps and deep gorges, was in most cases non-existent; there was still a justifiable fear of Maori hostility; and man settlers did not have sufficient capital to keep them while they broke i their land. As a result large numbers of prospective settlers sough what they hoped would be more profitable employment on th Thames goldfields and forfeited their land.[24]

In spite of this wholesale desertion, the town of Tauranga continue to grow, and within the next decade the recognisable nucleus with rectangular pattern of streets lined by wooden buildings of one c two storeys had developed. The depression of the 1880's retarded th

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[22] See 'Memorandum on Roads and Military Settlements in the Northern Island of New Zealanc *Append. Journ. House of Repres.*, (A-8a), 1863; and 'Further Papers relative to Native Polic Confiscation. . .', *ibid.*, (E-2c), 1864.

[23] C. W. Vennell: 'Tauranga in the Misty 'Sixties', *Journ. Tauranga Hist. Soc.*, September, 195

[24] 'Report on Lands Suitable for the Settlement of Immigrants at Tauranga', *Append. Jour House of Repres.*, (D-6), 1873.

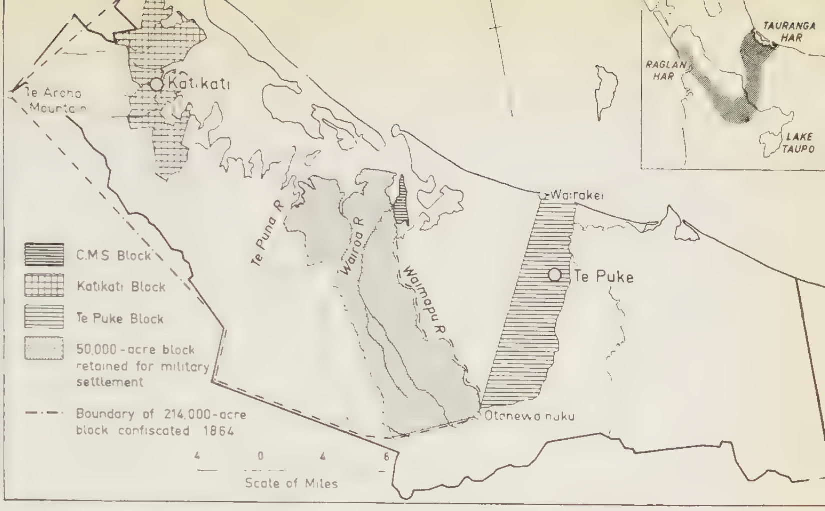

Fig. 7. European settlement in Tauranga county. (Inset: Grey's proposed belt of military settlement)

growth of the town, and the population declined. Nevertheless, the town retained its status as the port for the county and as its chief commercial and servicing centre. It was constituted a borough in 1882, and by 1900 the population had reached 945. In 1920 the inhabitants numbered 2,250.

SPECIAL SETTLEMENTS

The Stewart special settlements at Katikati and Te Puke were similar to those at Waipu, Feilding and Dannevirke—a group of people united by national sentiment and religion who wanted to preserve their traditions in a new land. George Vesey Stewart, a native of Northern Ireland, obtained jurisdiction over the Katikati and Te Puke blocks, organised and brought out to New Zealand five parties of immigrants mainly from Northern Ireland, sold them land and arranged for their settlement at Katikati and Te Puke. In 1875 twenty-eight families took up their land on the Katikati block and commenced to break it into farmland. They were followed in 1878 by 378 more immigrants from Belfast, and in 1881 forty-six settlers arrived to take up land on the Te Puke block. Two more groups of settlers followed, one to Te Puke the other to Katikati[25] (*Fig.* 7).

The Stewart special settlements, established a decade after the military settlement at Tauranga, began with greater advantages, and these ensured some measure of success. The threat of Maori hostilit had gone; proximity to Tauranga, an established port of entry an commercial centre, gave stability; access to the settlements, althoug not good, was better than that offered to the military settlers; th settlers took up larger holdings and in general had more capital t break them in; and most had already had some farming experience Although not all the settlers remained in the district, the specia settlements formed the nuclei of two European communities whic were later expanded by independent settlers, and in time two town ships developed at central positions on the two blocks to serve th needs of a growing number of farmers.

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[25] See A. J. Gray: *An Ulster Plantation*, Wellington, 1950; and Vesey Stewart pamphlets of 1877, 1878, 1880, 1883 and 1884 (in Turnbull Library).

The Expansion of European Settlement

From the 1880's onwards European settlement gradually spread ou over the fern land from Katikati, Tauranga and Te Puke along th shores of Tauranga Harbour and along the main roads. As soon as th native titles were established by the Land Court—and this usually too some time, especially in the eastern part of the county where title were more confused than usual with rival claims of both Arawa an Ngaiterangi *hapu*—the land was purchased by the Crown and sol to European settlers. Although some families bought land and settle independently, a large area was sold in blocks to groups of people suc as a society, or an association of local residents formed for the express purpose of settling on a particular block, or a group of capitalist who formed themselves into a company, developed the land as on block and then cut it up for sale at a profit.

Settlers breaking in new land were beset by many problems. Th first season's crops, planted in the ash of burntover scrub and fern passed all expectations, but in succeeding years yields diminished sometimes to quite a low level on the higher country. The fertility given by the ash was not replaced by artificial fertiliser and the soi became exhausted; ignorance of the settlers of the use of suitable grasses and methods of cultivation for the area made it difficult t maintain high yields. However, in the eastern part of the county ther was a greater problem. On land which to outward appearances supported good pasture cattle lost condition. The cause of this 'bush sickness' was not determined until the 1930's when the cobalt deficiency in soils derived from Kaharoa ash was discovered. Until then the only remedy had been to put stock on to areas of older soils in the western part of the county.

The shortage of finance during the general depression throughout New Zealand in the 1880's added to the difficulties of the farmers. Not a few of the settlers walked off their farms and sought employment elsewhere. Nevertheless, during the 1890's and early 1900's the area of land taken up in farms gradually increased, the pockets of cultivated land spread and coalesced until by the 1920's most of the lowlands about Tauranga Harbour and Te Puke had been broken in. The type of farming was a mixture of stock raising—sheep, beef, cattle and dairy cows—on pastures of English grasses and field crops, cereals and root crops. Each single-storey wooden homestead was surrounded by an orchard and vegetable garden. At first, most of the produce was for local consumption, but as more land was broken in and the settlers became established as farmers, there was more and more surplus produce for sale in Auckland or on the goldfields of the Coromandel Peninsula.

The Development of Communications

The slow development of communications within the county did little to hasten the spread of settlement by providing access to land away from the coast. Throughout the nineteenth century the chief means of contact between Tauranga county and the rest of New Zealand was by sea. Food supplies, building materials, fuel, clothing and general merchandise were all imported, mainly from Auckland, in small cutters and schooners which took away settlers' produce as well as a few passengers. Links with other settlements on Tauranga Harbour were maintained by small vessels which called regularly. During the 1870's Maketu was also a port of some importance for the Rotorua and Te Puke districts, it being a one-day trip by dray to carry goods to Rotorua. However, by the 1890's the mouth of the Kaituna River had become so silted up that Maketu was no longer practicable as a port.

The greatest hindrance to settlement in Tauranga county during the nineteenth century was the lack of adequate access by road. Maori tracks sufficed until the 1870's, when a coach route to Rotorua via Oropi was established, but this proved expensive to maintain, and an alternative route via Te Puke was put into use in the 1880's. Meanwhile the tourist trade had been developing rapidly. Tourists travelled by sea to Tauranga, stayed one or two nights, and then continued their journey to the Rotorua thermal area. By the 1880's the tourist route was well established while other roads were neglected, but this traffic ended virtually in 1894 when the railway to Rotorua was opened. A coach service was instituted between Tauranga and Thames in 1882 but the road remained in a semiformed state until the early twentieth century, and it was impossible to maintain a regular service. The connecting of Tauranga county with the upper Thames Valley by road was not completed until 1911 because of lack of finance, disagreement as to the best route over the Kaimai Ranges, and noncooperation between the various county councils concerned and the government.

As far as railways are concerned, the growth of business on the Waihi goldfields led to agitation for the extension of the Auckland-Paeroa line. By 1905 it reached as far as Waihi, but it was not until 1928 that the line between Waihi and Tauranga and on to Taneatua was opened for traffic.

THE GROWTH OF INDUSTRY

Poor communications by land meant that reliance had to be placed on goods imported from Auckland at some expense. Because of this isolation in the early stages of rural settlement, most of the food requirements of the settlers were grown and processed on their own farms, but with the growth of townships at Katikati, Tauranga and Te Puke, there was an increasing demand for food. Farmers could produce sufficient raw materials such as milk and wheat, but few had the facilities to manufacture butter, cheese or flour to meet the town markets. Consequently, the first industries established in Tauranga county were those concerned with processing, particularly of dairy products. These were followed by other enterprises, usually on a small scale, such as flour milling, fruit processing, fish curing, brick making and processing of sulphur from White Island.

Although there was no lack of enterprise on the part of the local inhabitants of the county, there was, as a result of the general depression of the 1880's, a marked shortage of capital. Many companies went into liquidation, often within a few months of their establishment. In addition, some firms, such as those engaged in the manufacture of butter and cheese or making bricks, found difficulty in obtaining their raw material in sufficient quantity and of a standard quality in order to run their factories economically. Of all the enterprises attempted, only the dairy industries with factories at Katikati, Tauranga and Te Puke survived, in spite of a chequered career, into the twentieth century. By 1900 the character of Tauranga county as a primarily agricultural area was well established, but the comparatively small population did not yet warrant the establishment of factories other than those associated with the processing of primary produce.

Timber, gold and kauri gum were the chief natural resources exploited in the county. None of these was of any great significance in the New Zealand economy, but locally these activities added further distinctive features to the pattern of settlement. Digging for kauri gum was relatively insignificant and confined to a small area inland of Katikati. Although prospecting for gold was carried on in many parts of the Kaimai Ranges, the gold workings and batteries on the Eliza claim, near Katikati, and at Muir's Reef, near Te Puke, were the only visible evidence of gold mining. On the Eliza claim mining installations were put in at a cost of £2,000, but the lode formation was narrow and close to the surface and the only crushing recorded was of twelve tons of quartz which yielded five ounces of bullion worth £14.[26] Although many claims were staked out in the hill country west of Te Puke, the Muir's Reef claim was the only one to yield gold of any consequence in the area. Most of the mining was by shafts and the quartz was crushed in a battery, although there was some sluicing of river banks. The total output of the Muir's Reef mine from the start of operations in 1895 until it closed in 1928 was 63,467 tons of quartz which yielded 54,172 ounces of bullion worth £164,184. The payable values were only in the first 200 feet of the mine which reached a total depth of 515 feet.[27]

TIMBER MILLING

In spite of the proximity of a large area of bush, little timber milling was undertaken in Tauranga county before the 1880's except for the occasional splitting of fence posts from trees on the forest margins. Apart from the fact that most of the forest was Maori-owned until the 1880's much of it was in difficult country, and it was more economical to ship timber from the Coromandel Peninsula to Tauranga. During the 1890's the kauri on Coromandel became scarce and timber millers began to work further south into the bush behind Katikati toward the southern boundary of the kauri forests. When the kauri was cut out the millers had to concentrate on other native timbers such as rimu, miro, totara and matai. There was no market for tawa although it was also abundant.

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[26] J. F. Downey: *Gold Mines of the Hauraki District*, Wellington, 1935, p. 254.
[27] *ibid.*, p. 253.

The first mills in the 1880's were very small establishments and all timber was cut with hand saws. Within the next thirty years at least twelve mills, each with its own millworkers' camp and bush tramway, were erected in the bush-covered hill country of the Kaimai Ranges and the Patetere Plateau. Wooden tramways were put in and all logs were felled within a radius of one half to three-quarters of a mile and were hauled to the end of the tramway by steam haulers or by bullock teams. When one section of bush was felled, more track was constructed, the steam hauler was winched to a new site, and operations were renewed. By the 1920's steam locomotives were replacing animal haulage on the tramways, but horses were still in use in the Oropi district as late as 1927. Logs from the mill at Whakamarama were brought out by steam on a steel track as early as 1913.

Changing Patterns of Maori Settlement

Maori life, after 1860, became more and more influenced by European ways. The introduction of the musket had meant some modification in the construction of the ancient pa developed to withstand assault by an enemy armed with spears, but by the late 1860's there was no longer any need for fortifications. Pallisades were left to decay and many a *hapu* moved from its homes on the hill tops or in the forests to a coastal location so as to be nearer European trade. (Compare Figures 8 and 9.) In 1875, the Nga Potiki of Karekare, on the eastern shores of Tauranga Harbour, had taken up boat building and making gigs in addition to cultivating wheat, maize and potatoes with European ploughs and harrows. Crops were no longer all grown communally, and many Maoris had individual holdings fenced and sown in grass or field crops. In 1891, 400 acres in Tauranga county were cultivated individually by Maori owners; by 1906, there were 4,415 acres under individual cultivation.[28] However, the problems of communal tenure and of underdevelopment of the remaining Maori land were far from solved.

The village, with the additional feature of the chapel dating from the

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[28] *N.Z. Census*, 1891 and 1906, Wellington.

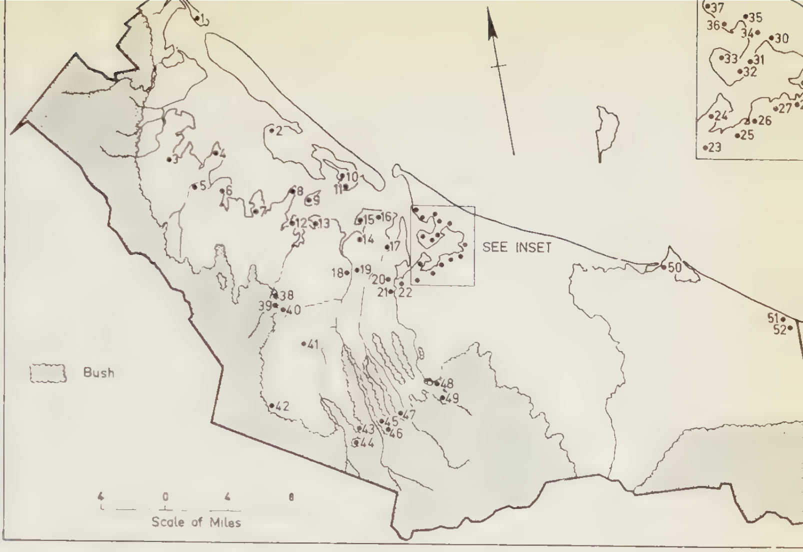
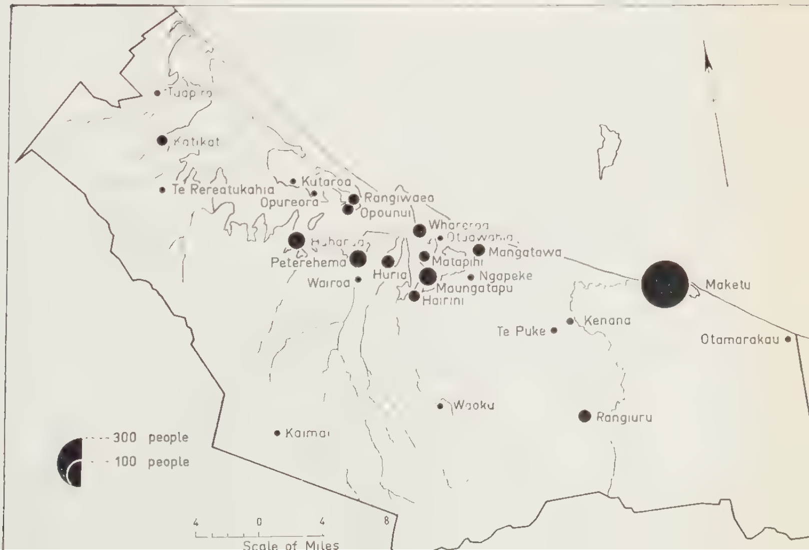


Fig. 8. Maori villages c. 1860

In Figure 8 the villages are as follows:

1. Otawhiwhi
2. Matakana
3. Rereatukahia
4. Matahui
5. Te Ngarue
6. Oraua
7. Paritawhau
8. Omokoroa
9. Motuhoa
10. Tongoio
11. Opounui
12. Ongarahu
13. Poututerangi
14. Peterehema
15. Matuaiwi
16. Otumoetai
17. Huria
18. Purakautahi
19. Poteriwhi
20. Okaheke Tongaparaoa
21. Poihakena Ranana
22. Hairini Poike
23. Utimingi
24. Maungatapu
25. Ohinekahu
26. Auhitokitoki
27. Te Apatitu
28. Te Rauwahine
29. Te Mania
30. Karikari
31. Tumatanui
32. Tukiata
33. Matapihi
34. Otuawahia
35. Patene
36. Whareroa
37. Opoutea
38. Waiwhatawhata
39. Whakamarama
40. Te Irihanga
41. Poripori
42. Kaimai
43. Paingaroa
44. Te Kaki
45. Akaaka
46. Taumata
47. Maenene
48. Waoku
49. Oropi
50. Maketu
51. Otamarakau
52. Waitahanui

Fig. 9. Maori villages in 1881



missionary era, remained the unit of Maori settlement throughout the nineteenth century. Many buildings, particularly the meeting house, were still constructed in traditional style, although some families were building European-style wooden bungalows with somewhat less picturesque results. One, situated at Waihi, near Maketu, in 1877, contained four rooms and was built at a cost of £160, but once it was built, the owners had no idea of furnishing it or making it comfortable, nor had they the income to maintain it.[29]

The Maoris were learning very quickly to accustom themselves to European ways and to make use of European material benefits, but in spite of this, what the missionary, Brown, wrote in 1852 was still true at the end of the nineteenth century: 'The mills, vessels, cattle and cornfields in the district mislead a passing traveller as to the advance of these natives in civilisation for there is no corresponding improvement in their houses or attire or habits of cleanliness'. Throughout the latter half of the nineteenth century, the Maori population of Tauranga county continued to decline. Wars had caused some loss of life before the 1860's, but introduced European diseases took a greater toll Epidemics were frequent and, badly housed, badly clad, badly fed and with little medical aid, the wretchedness of the people in some villages was extreme. Nevertheless, by the 1890's this decline was levelling off and, in spite of gloomy predictions to the contrary, by the early twentieth century, the Maori population was increasing.

Conclusion

No attempt has been made in this study to discuss changes which have taken place since about 1920, for it is felt that the developments within the last thirty or forty years and the complexity of present-day patterns of settlement in Tauranga county are worthy of separate study. Katikati has retained its character as a small local service centre for the immediate farming district. Te Puke is also well established as the centre of a productive farming district and, before the second World War, threatened to oust Tauranga from its position as chief town in the county. However, the opening up of the timber industry on the Volcanic Plateau and postwar development as a port and as an industrial and commercial centre have strengthened the position of Tauranga as the chief town of the Bay of Plenty. The development of Mount Maunganui from a waste of scrub-covered sand dunes at the beginning of this century into a flourishing seaside resort, port and industrial area is also of comparatively recent date.

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[29] T. S. Grace: *A Pioneer Missionary among the Maoris*, Palmerston North, [n.d.], p. 277.

The boundaries of rural settlement have, since 1920, been pushed further inland with the reclamation of more areas of scrub and fern and forest as well as of coastal swamp. The introduction of more efficient farm machinery and of better methods of cultivation, the control of disease, and the application of fertiliser, particularly cobaltised superphosphate, have made farms in Tauranga county more productive. In addition to dairy farming to supply the three factories at Katikati, Te Puke and Tauranga and to the fattening of store stock, the development of commercial fruit growing, especially of citrus and subtropical fruits, has been a feature of the last thirty years.

Except for the steeper areas of the bush-clad ranges to the south, most of the Tauranga county has been completely transformed. The waste of fern, scrub and swamp, broken occasionally by a pallisaded Maori village and its patches of cultivations nearby, has been replaced by a closely-settled landscape of fields of pasture and crops, exotic shelterbelts and hedges, orchards and market gardens, roads and power lines, and European towns with all their varied assemblage of buildings. This study has attempted to show the different stages in this transformation, to relate the successive patterns of settlement to the cultural patterns of the people, and to discuss the impact of an immigrant population on the original inhabitants whose culture was so widely divergent from that of the newcomers.

THE AIR-FREIGHT INDUSTRY OF NEW ZEALAND*

J. W. MACNAB

NEW ZEALAND, because of its broken terrain, has isolated communities often poorly served by surface transport, and in such a country, air transport is naturally of great significance (*Fig.* 1). In the following survey the specific elements of air transport which are considered are speed, cost and service.[1]

Speed gives air transport its greatest advantage. Not only is time saved by the swiftness of the machine, but also by its directness of movement—movement almost unhampered by surface obstacles and restricted only by the necessity to keep to traffic lanes. Fast transit is of obvious advantage for medicines, perishable goods and livestock, and is also important in commerce as it enables retailers to carry small stocks, thus reducing capital commitments.

Cost is a dominant factor, for aircraft are expensive to purchase, maintain, insure and crew, and only by full utilisation of the aircraft can these costs, many of them unaffected by the degree of utilisation, be spread over a greater volume of cargo. Capacity in aircraft is measured by weight rather than volume. The payload ratio is poor, for generally less than one third of the all-up weight can be cargo—in contrast to a motor lorry which carries three times its unladen weight. It is possible to transport most cargo by air today, but aircraft which are efficiently utilised are limited to urgently-needed, light-weight or high-inventory cost freight. High costs are not limited solely to the aircraft, for aerodromes and navigational aids are expensive to construct, maintain and operate, and identical facilities are necessary at both major and minor airfields. Costs to the client are of prime importance and freight charges must be competitive, for the service given, with the charges imposed by surface transport.

Service by air may have great advantages for the client. Damage and theft of air freight are infrequent, and insurance charges are con-

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*The present survey excludes agricultural aviation. The tonnage uplifted for agricultural purposes is far greater than that carried on scheduled and charter air services.

[1] For some general considerations relating to air transport see R. O. Buchanan: 'Air Transport, Some Preliminary Considerations' in L. D. Stamp and S. W. Wooldridge (Eds.): *London Essays in Geography*, London, 1951, pp. 59–70. Specific acknowledgement is made to L. J. Elton: 'Air Freighting in New Zealand' (unpublished article).

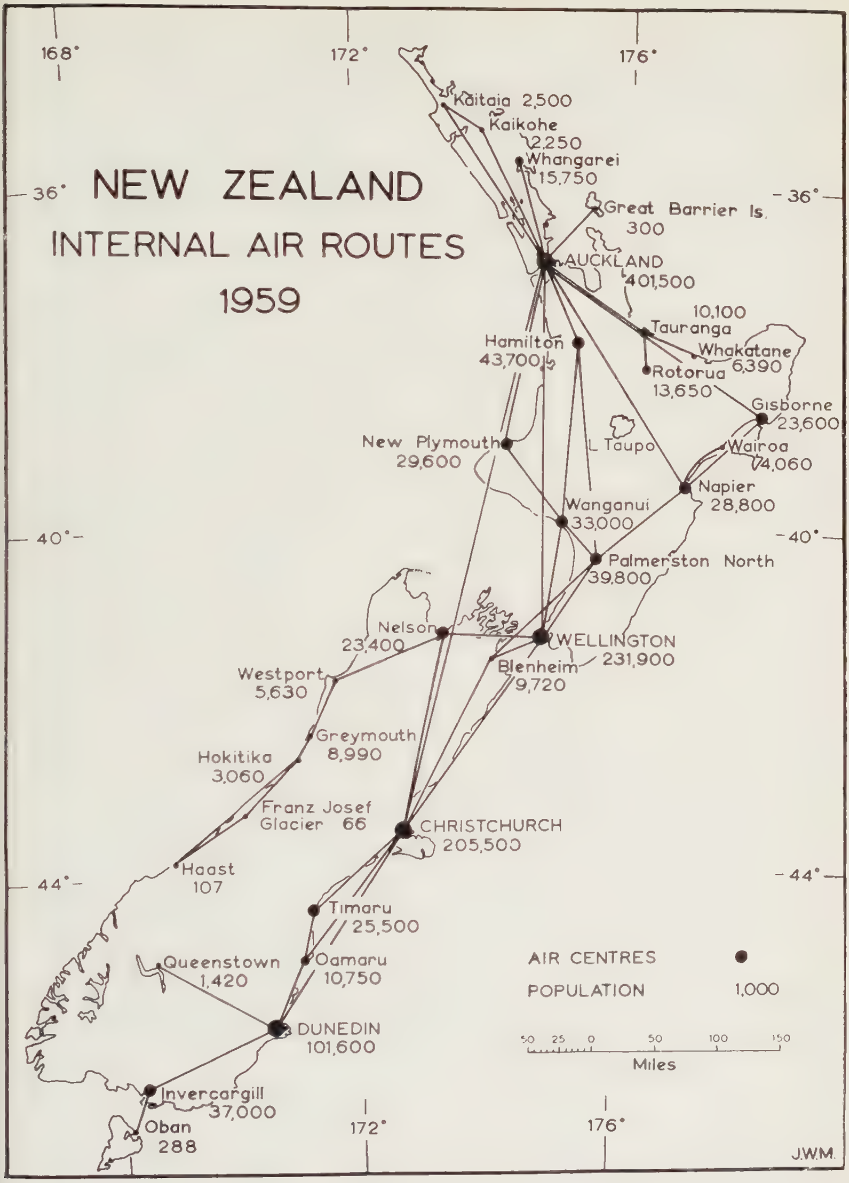

Fig. 1. Internal air routes in 1959 and the centres served. Figures refer to population and are official estimates for 1959

sequently small. Carriage of goods by air is flexible, with service hampered only by the provision of airfields or the occurrence of suitable waterways and the availability of aircraft. Frequency and regularity are essential features to enable clients to plan their requirements in advance. Dependability is equally as essential since small delays could nullify the advantages of speed.

Most of the air freight in New Zealand is carried by one of two companies: New Zealand National Airways Corporation (N.A.C.) a state corporation, and Straits Air Freight Express (S.A.F.E.), a private firm under contract to the New Zealand Government Railways.[2]

New Zealand National Airways Corporation

N.A.C. commenced operations on 1 April 1947, having taken over Union Airways of New Zealand. Under its charter N.A.C. has to provide a comprehensive air service throughout the country and this forces the corporation to maintain flights which otherwise might be discontinued on economic grounds. In the past, to reduce costs, a policy of standardisation on Douglas D.C.3 aircraft was adopted, but with the increasing cost of spares for the twenty-six D.C.3's and their increasing obsolescence, new aircraft were required. Three Vickers Viscounts were purchased. However, the corporation has continued its standardisation policy, and for replacement aircraft suitable for smaller aerodromes has ordered Fokker Friendships, the engines of which are essentially identical with those of the Viscounts.

Air-freight services are complementary to passenger services, and approximately three-fifths of all air freight is carried on passenger aircraft and only forty percent on the four scheduled D.C.3 freighter aircraft. This enables N.A.C. to give a speedy frequent freight service to a wide area, and it is stated that the profit on the freight service is made by using the 'waste' space in passenger aircraft. With the utilisation of passenger aircraft thus more complete, the total revenue load factor of the corporation is the very high one of seventy-five percent, and this enables costs to be cut.

Freight depots in the main centres are often sited for convenience adjacent to the passenger air terminal, for half the freight is carried on passenger coaches to the airport. It is divided into three classes based on the degree of urgency: ordinary air freight; 'Freightair Express' parcels, charged at double rates, which are accepted up to a few minutes before coach departure time and are carried by the first possible aircraft; and 'Freightair Cargo' which has the lowest priority and comprises goods which call for faster than surface transportation but for which there is no great urgency. The charge for this last service is twenty-five percent below ordinary air freight.

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[2] For statistical information for the years 1946 to 1959 relating to these services see: 'Report of the Railways Department', *Append. Journ. House of Repres.* (D-2); 'Report of the New Zealand National Airways Corporation', *ibid.*, (H-35); 'Report of the New Zealand Air Department', *ibid.*, (H-37); and 'Report of the New Zealand Civil Aviation Department', *ibid.*, (H-37a).

At the airport the packages are sorted into destination bins before being loaded separately into the aircraft. Loading is a task demanding skill, for the trim of the aircraft must be maintained and cargo for intermediate destinations must be readily available. This operation may keep the aircraft on the ground for periods up to an hour—a disadvantage in that it reduces earning capacity. Nevertheless, in 1958–1959 freighter aircraft averaged 1,384 hours in the air and passenger aircraft 2,147 hours.

From the terminal airport, where urgent freight is sometimes delivered directly, the packages are taken to the city depot. To speed delivery, consignees are notified by telephone and many parcels are collected from the depot. Other parcels are delivered by local carriers at a fixed charge of 1s. 3d., a sum sufficient to cover the cost of delivery in the main centres but inadequate in the smaller towns.

Flowers, day-old chicks, serums and vaccines are frequently transported by N.A.C. Oysters, too, are typical air freight. Once carried unshelled by sea and rail, now shelled and chilled, they are transported by air. Motor spares also are common, the advantage here being in the reduction of stock that retailers have to carry. Most freight carried by N.A.C. has one of two things in common; urgency or light density.

On charter flights, different types of cargoes are uplifted. Interisland household removals are common, the D.C.3 taking the contents of an average-sized house. Complete factories have been shifted, advantages being in the speed, the smaller loss of production time, and the reduced need for packing. Charter flights utilise the aircraft more fully, and as costs are on an hourly basis, load factors are of little concern to the company and a definite profit can be guaranteed.

The Rail-Air Service

In conjunction with the R.N.Z.A.F. in 1946 a through booking service for parcels was introduced[3] and later in the year interisland freight was carried by air during a waterfront dispute, and the idea developed of linking in this way across Cook Strait the trunk railway systems of the two islands. This service commenced on 10 February 1947, using at first Douglas aircraft chartered from the R.N.Z.A.F. and later from N.A.C. In May 1951 S.A.F.E. took over the contract, and, pending the arrival of Bristol Freighters, a foreign company, Civil Air Transport, assisted in operating the route. New Zealand Railways had the great advantage of existing traffic facilities with a wide distribution of freight depots, a communications system, advertising and canvassing sections, and staff for freight handling and administration. Only at points of transfer from railway to aircraft did new staff and facilities have to be provided, and as this was only an extension of an existing system, costs could be kept low.

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[3] N.Z. Railways: 'Rail-Air Service—History and Description', *Information Sheet*, 1955.

Emphasis is on the linking of the railways rather than on the carriage of freight by air, and the air part of the journey is reduced to the minimum. Scheduled flights are made from Wellington to Blenheim and Nelson only, and ultimate delivery to other centres is by rail. Goods are longer in transit than those carried by N.A.C. but charges are lower as the air part of the journey is small. An advantage of the short route is that the majority of the load of the aircraft is payload. not fuel, but aircraft are refuelled only in Wellington as aviation spirit is cheaper there.

The Bristol freighters employed on this service were constructed without the usual floor, and in its place two removable trays known as 'cargons' are run on small wheels along fitted channels, the weight saved in the floor compensating for the 468-pound weight of the cargon. The great advantage of the cargons is that they permit 'pallettised' loading. At the Wellington rail terminus the freight is unloaded from goods vans, sorted and distributed evenly over the cargons. Lashed down and covered with tarpaulins, the trays, each loaded with up to 600 cubic feet of freight, are pushed on to a lorry and its trailer, and are taken to the airfield. At the main airports, the trays are loaded on to a laterally-movable platform called a traverser. The Bristol taxis into alignment with an empty traverser, which receives the inward cargo and is then moved aside. The traverser loaded with the outward freight is moved into position and the trays are winched into the aircraft (*Fig.* 2). Turnround of the aircraft can be as little as eight minutes, and this is the great advantage of the system as aircraft are kept in the air and thereby earning. However, the total amount of handling is not reduced and the trays, ropes and tarpaulins are a considerable deadweight.

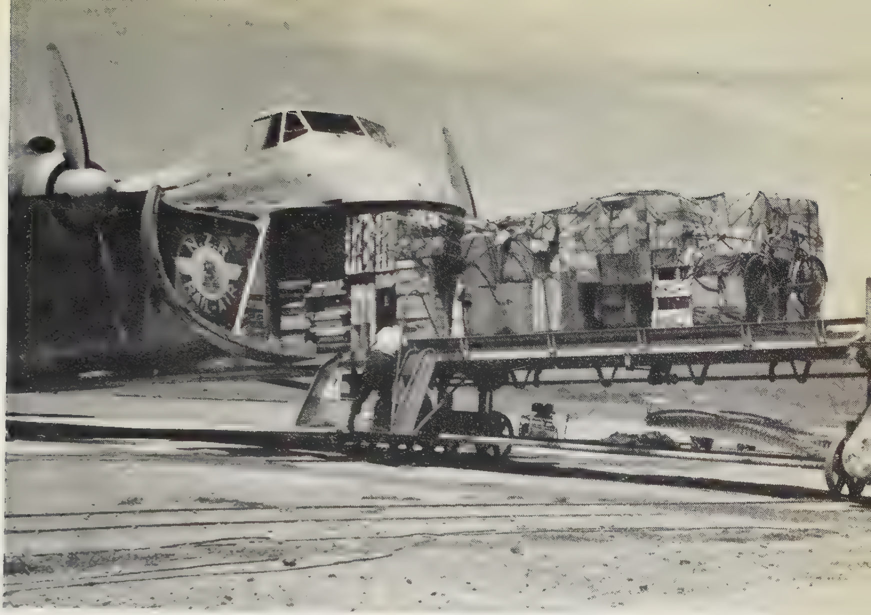

Photo: Civil Aviation B

Fig. 2. Cargons being winched into the aircraft

At the terminal airport the procedure is reversed, and eventually the incoming cargo is loaded into railway vans at the depot. The arrival time of these vans at their destination is dependent, of course, on the frequency, speed and type of train to which they are attached, and although priority destination cards are attached to the vans, these operate only to subterminals such as Wanganui or Hastings where freight may be resorted and transhipped to local trains. Though the flight time over the fifty miles from Wellington to Woodbourne is only twenty-five minutes, the overall speed between any two points is not great when compared with a direct air service because of the restriction imposed by rail transport, but it compares favourably with rail-sea interisland transport.

An average of twenty return trips is flown between the two main air terminals each day, but as there is a greater volume of freight outwards from Wellington, two or three of the return trips are empty. Under their licence the railways are not able to divert any of their normal rail-sea traffic to the airways, but trips by aircraft that would otherwise be empty are sometimes used by the railways for their own purposes. The most notable occasion was the carriage by air to the North Island of railway waggons surplus to South Island requirements.

Cargo carried by S.A.F.E. is varied, but emphasis is on heavier goods, the only restriction being the size of the individual package.

Horses, motor cars, quick-frozen vegetables, fruit and general merchandise are featured in advertisements. Rates are calculated on a different basis from those of N.A.C. and are stated as being as cheap as or cheaper than surface transport, but it is difficult to gauge the validity of the rates charged as details of expenditure and costs are not published.

Charter flights, too, are undertaken and in this sphere, as with priority parcel traffic, S.A.F.E. comes into competition with N.A.C. One disadvantage of charter flights away from the usual terminals with mechanical loaders is that the Bristol aircraft loses some of its advantages because the tail must be raised to the horizontal before the cargons can be winched into the cargo bay from the special lorries.

Regular flights, which were, however, classified as charter flights in 1959, were those bringing eggs from Oamaru and Christchurch to Wellington. Two flights each week were guaranteed from Oamaru, and for the year ending 31 March 1959, 20,800 crates, each containing thirty dozen eggs were uplifted.[4] To handle this large quantity 101 flights were made, each load averaging 207 crates weighing sixty-three pounds each. (In 1959 only 2,500 crates of eggs were moved as formerly by sea from the port of Oamaru.) When direct air transport was not available from Oamaru, the balance, some 400 crates weekly, was railed to Christchurch or Blenheim. From Christchurch the number of eggs flown to Wellington rose from 282,250 dozen in 1954-1955 to 534,410 dozen in 1958-1959. Air-freighting of eggs was popular with the client as reduced handling led to fewer breakages, and a fresh product was delivered to the consumer, and it was popular with the airway company because regular full cargoes between two main airports are always desirable. However, since the new Wellington airport at Rongotai came into operation these flights have been discontinued and all eggs are now railed to Blenheim.

In 1958-1959, though S.A.F.E. uplifted 76,280,139 pounds of freight compared with the 22,946,413 pounds of N.A.C. the freight ton-miles flown by that company were only 2,526,734 compared with 2,811,065 for N.A.C. These figures emphasise the fact that S.A.F.E. carried heavy cargoes a short distance, an average of seventy-four miles, whereas N.A.C. carried lighter loads longer distances, an average of 319 miles.

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[4] Personal communication.

SMALL AIRWAYS COMPANIES

Small companies, often operating with only one machine, carry only limited quantities of freight and their services are supplementary. West Coast Airways, which operates from Hokitika to Haast, is the most important. This company, formed in 1956 to take over the scheduled South Westland route from N.A.C., carries passengers, but handles also foodstuffs and household goods for the settlements at Haast and Okuru and urgently-required machine parts for the Ministry of Works. From the south, whitebait is the chief cargo, but northbound freight is only one quarter the total of that southbound. In 1958-1959, 95,971 pounds of freight and 73,842 pounds of mail were carried.

Typical of the small operators are three other companies. Amphibian Airways, operating from Invercargill, carried 107,165 pounds in 1959, fifty-three percent being general freight for Stewart Island. Every three weeks six hundredweight of provisions are carried to Puysegur Point lighthouse. Charter flights are made into Fiordland and the southern lakes, and freight on these trips comprises supplies and equipment for hunting and fishing parties. Midland Air Services of Auckland carried three-quarters of their 32,636 pounds of perishable goods, food, automobile spares and machinery to Whitianga, and only newspapers to Waihi Beach, Whangamata and Tirua. Auckland was the point of origin for ninety-seven percent of the freight. New Zealand Tourist Air Travel serves the islands of the Hauraki Gulf thrice weekly as well as providing charter flights for sword-fishing parties to the Bay of Islands and for trout-fishing parties to Lake Taupo. Outward freight is mainly groceries, automobile parts and machinery, and return freight, crayfish. In 1959, 29,054 pounds of freight were carried. Though the total volume of freight carried by these companies is not great, it is of importance to the scattered communities which they serve and of interest because of its diversity.

FREIGHT MOVEMENT

In the South Island, movement of air freight is, in general, parallel to the coast (*Fig.* 1) because the most important towns have a coastal situation and the Southern Alps are a barrier to easy east-west communications. Neither N.A.C. nor S.A.F.E. operates scheduled services between Canterbury and the West Coast. In the North Island the pattern of air routes is more complex because of the necessity to connect the more evenly spaced large towns.

TABLE I

FREIGHT MOVEMENT FOR YEAR ENDING 31 MARCH 1954*

*Airport***	*Inwards* (lbs.)	*Outwards* (lbs.)
Wellington	24,309,476	26,456,354
Blenheim	19,569,124	17,863,232
Christchurch	3,282,958	3,602,286
Nelson	2,843,794	2,252,826
Auckland	1,174,242	1,808,187
Oamaru	875,613	1,405,183
Dunedin	769,904	610,293
Palmerston North	340,651	276,695
Invercargill	158,792	246,395
Gisborne	580,273	154,610
New Plymouth	230,421	98,289
Napier	210,291	96,906
Hamilton	176,866	93,140
Kaitaia	142,225	20,641
Hokitika	46,729	66,610
Whangarei	62,170	19,071
Westport	45,335	24,902
Kaikohe	48,042	14,797
Tauranga	48,294	9,206
Greymouth	63,232	8,445
Timaru	6,255	3,467

*Based on returns made to the Civil Aviation Department. Inward freight has not been recorded since 1954.

**Wanganui was not operated in 1954.

Broadly speaking, the airports of the largest cities in New Zealand handle the greatest volume of freight, but there are exceptions. The dominance of Wellington and Blenheim (*Fig.* 3) is due, not to the size of the urban centre, but to the rail-air link. Oamaru airport is another exception because of its importance to a similar service. Remote places with poor land communications have a large volume of air freight. Nelson, the outstanding example, no longer has a regular passenger-freight sea service, its short local railway, now discontinued, was never connected to the South Island main trunk railway, and its chief means of transport is a subsidised road service.

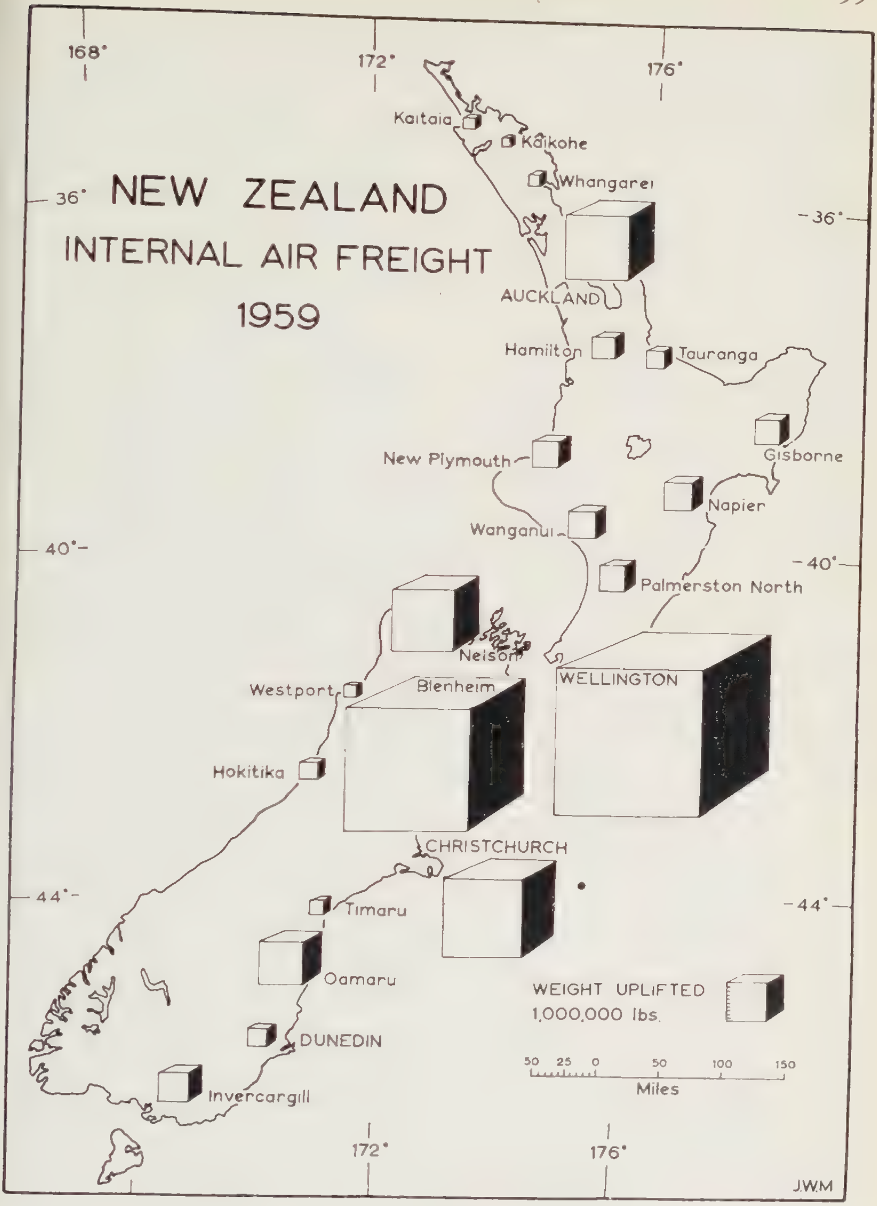

Fig. 3. Outward movement of air freight in year 1958–1959

Today it is unique in that the only direct service provided by New Zealand Railways to that centre is by air. To Kaitaia with only road services, an air service is equally essential.

The disparity between inward and outward freight (Table I) depends on a multiplicity of factors, investigation of which is beyond the scope of this survey; but a few points may be emphasised. Six airports, Auckland, Wellington, Christchurch, Invercargill, Hokitika and Oamaru have a larger volume of outward than inward freight. For the first five places this is to be attributed in part to terminal location and to function as transhipment centres. Auckland, Wellington and Christchurch in addition are important manufacturing centres. Oamaru until 1960 was a transhipment centre, but an artificial one. It had a large volume of outward cargo because of its specialised air freighting of locally-produced eggs, but the inward volume of cargo was inflated by the necessity of filling the empty southbound aircraft. Much of the inward air freight was transhipped to the railway for forwarding to its destination.

The smaller air centres are recipients of freight—in general, manufactured products such as machinery, glassware, motor spares, hardware, electrical equipment, processed foods, medical goods, millinery or clothing. The freight uplifted from the smaller airports is chiefly unprocessed, seasonal, perishable products—fruit, vegetables, nursery plants, flowers, oysters or whitebait. There are exceptions to this, as from local industries originate specialised goods such as insecticides from New Plymouth, underfelt from Wanganui, patent foods from Palmerston North, and canned and frozen goods from Gisborne.

The Growth of Air Freight

In 1936, 26,123 pounds of freight[5] and 19,431 pounds of mail were carried by aircraft. Ten years later, the weight of freight had risen to 338,950 pounds, but that of mail, 428,709 pounds, exceeded it. After 1946, though airmail had risen in volume, its relative importance has declined with the tremendous increase of other cargo carried by air. (See Figure 4.) Compared with many other countries, internal airmail in New Zealand is unimportant. In 1957[6] the ton-miles performed in New Zealand were 270,303; in Japan 529,598; in the United Kingdom 1,050,023; in Australia 1,515,409; and in the U.S.A. 91,127,544. The overall growth of air freight in New Zealand is shown in Figure 4. The great increase in 1952 was the result of a wharf labourers' strike when the only means of transporting cargo between the North and South Islands was by air. Scheduled freight is now dominant.

For total freight carried in 1957 the United States led the world with 379,197,650 ton-miles, Australia was second with 32,620,422 ton-miles, and New Zealand was in eleventh place with 4,783,505 ton-miles, but its rate of development was generally higher than the world average. New Zealand airways companies have a weight load factor of seventy-six percent, a figure well above the world average of fifty-six percent and exceeding the sixty-three percent of Australia, the sixty percent of the United Kingdom, and the fifty-three percent of the United States. This figure by itself cannot be taken as a measure of efficiency of an airline, but rather must be regarded as a reflection on the adequacy of the service provided. Some airline companies consider that if the load factor rises above sixty percent more flights are necessary, even though the aircraft are capable of being more fully utilised.

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[5] See *Append. Journ. House of Repres., op. cit.*, 1936.

[6] Abstracted from I.C.A.O. returns.

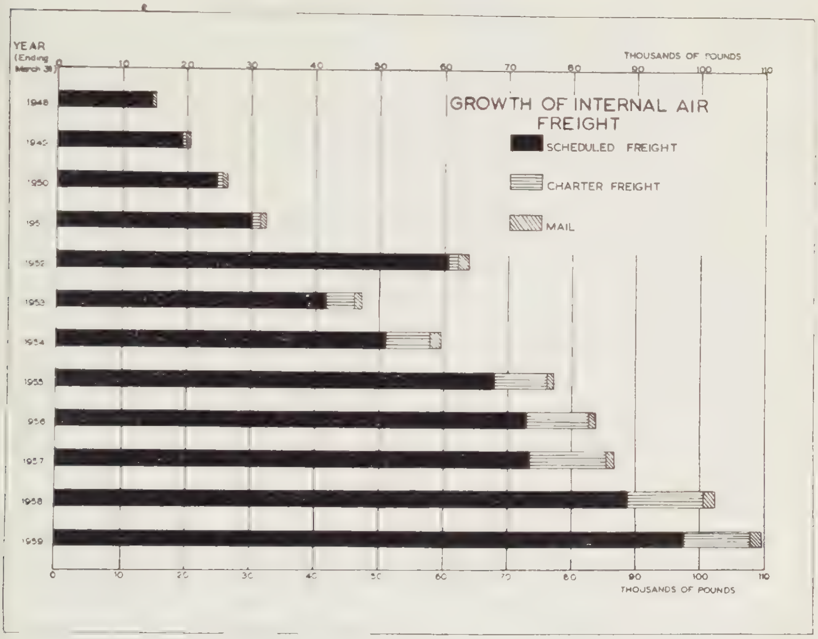

Fig. 4. Growth of internal air freight in New Zealand, 1948–1959

CONCLUSION

It is relevant here to assess the principal considerations of air freighting as they apply in New Zealand. Speed is of great importance, but with the relatively short routes, the reduced time of air travel does not have a great effect on the total time taken for the delivery of goods. Present jet aircraft are not suitable as distances are too short for them to make efficient use of their higher operational altitudes, and, in addition, many New Zealand airfields are too small. Of more importance than speed in the air is time taken in handling and in surface transport between airport and destination. S.A.F.E. with its cargon system of loading, and N.A.C. by its use of passenger coaches for some freight, have reduced surface delays.

The United Kingdom Civil Aviation Mission of 1948 recommended that N.A.C. should retain a state monopoly and that subsidiary air routes only should be operated by separate companies. This broad policy has not been followed in the field of air-freight services and there is some duplication, as in flights between the North and South Islands, and consequently there is duplication of aircraft, personnel, maintenance and handling facilities, all increasing costs to the clients.

ROLE OF THE TRAIN FERRY

The object of the railways in maintaining an air service is to link the two trunk lines, and goods carried across Cook Strait are often heavy and unwieldy. In this case it is clear that the railways do not compete with N.A.C., but it is questionable whether heavy and unwieldy goods should be carried by air since the payload of an aircraft is small. Air freight could be assessed on a density-value basis, but as far as the writer is aware this has not been attempted. The projected train ferry will almost certainly carry the heavy freight in the future but to be profitable, this ship will need to carry much more than the railway's present share of the interisland freight (some 80,000 tons per annum). However, it is envisaged that the ship will carry cars as do similar train ferries across the English Channel, and so revenue will be increased. The advantages of the ferry will be essentially the *reduced* time from rail end to rail end, and the reduction of handling, as goods will remain untouched in the railway waggons. Such a ferry will lack the flexibility of aircraft, but frequency of trips between Wellington and Blenheim is of little consequence when goods are delayed in loading and unloading and there are only a limited number of trains leaving the terminals each day.

Nevertheless it is possible that the introduction of a train ferry will be a retrograde step. All forms of transport appear to have evolved in a similar manner—from experimental and personal conveyance, to public passenger transport, to combined passenger and freight vehicles, and finally to separate passenger and freight units. The aircraft industry has just entered the final phase with the recent development of freighter aircraft, and although at present the proposed train ferry has advantages over the existing rail-air service this will certainly not be true in future. The cost of air freight per ton-mile is rapidly approaching parity with surface transport, and air routes have the advantage that they are shorter than their surface counterparts. Consequently, it may be profitable in the future to eliminate the rail part of the rail-air service, as has been done between Nelson and Wellington. Direct service between two terminals without intermediate stops could be provided and only the major advantage of the S.A.F.E. operations—mechanical loading—be retained.

Complementary Nature of Transport

New Zealand can no longer afford to give 'protection' to outmoded forms of transport which, because of changing circumstances or sheer inefficiency can no longer compete;[7] but air transport can be complementary to surface transport. In these narrow islands where land, sea and air routes run closely parallel there is inevitable competition. Railways are subsidised by the state since there is a large annual loss, sea transport is subsidised by the provision of navigational aids and certain port facilities, and air transport by navigational aids and provision of airports. Each service has its part to play and should not be subsidised at the expense of its competitors to enable it to carry freight for which it is not suited, often at increased cost to the client.

Despite the physical barriers of the New Zealand terrain and the difficulties imposed by small unsealed airfields which are often not equipped for night operations, in spite of the use of semiobsolescent aircraft, and although it has a small population, New Zealand ranks high in the world as a carrier of air freight. The position changes rapidly owing to economic and political pressures, but, in general, transport of freight by air is increasing because the service provided, when compared with surface transport, is efficient, reasonable in cost, and speedy.

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[7] E. A. Gibson: 'Development of Aviation in New Zealand, and its place in the New Zealand Transport Industry', address to the Road Transport Federation, May, 1956.

RECENT LITERATURE ON MANUFACTURING IN AUSTRALIA

G. J. R. LINGE

PUBLICATION of the map, 'Manufacturing Industries', one of the final set which completes the *Atlas of Australian Resources*, suggests that this is an opportune time to discuss briefly the more accessible literature on the present nature and location of manufacturing in Australia of interest to geographers.[1] It must be admitted at the outset that geographers themselves have given scant attention to this sector of the economy which, on 30 June 1960, employed 1,182,000 persons, or about thirty percent of the total labour force. No doubt one reason for this is the paucity of the information published for areas smaller in size than the states, and the rigid enforcement of the 'disclosure rules' by the statistical bureaux. Research workers can use a considerable range of statistics at commonwealth and state levels[2] but have to be content with tantalisingly few for the statistical or administrative divisions withi the states.[3] Thus, the extent to which published factory statistics can be manipulated to give useful areal analyses or meaningful indices is extremely limited.

THE ATLAS OF AUSTRALIAN RESOURCES

The map, 'Manufacturing Industries',[4] is the first real attempt to overcome thes limitations and to show in detail the location of secondary industry. Nine maps of the complete continent are set out on one sheet. Based on information contained in the 1954 census, the centre map shows most towns in Australia with a population of at least 1,000 (750 in Tasmania) and, by use of proportional circles, the number of persons recorded in manufacturing industry and the share this forms of the total labour force. For towns with more than 2,500 factory workers these proportional circles have been further subdivided and coloured to show the relative importance of six main groups of industry. Although this is a very detailed map and one which can be fully appreciated only after close study, it does succeed in conveying an immediate impression of the concentration of factory employment south and east of a line from Brisbane to Adelaide.

The surrounding maps show, by a system of coloured symbols, the distributions of the significant centres of activity of no less than eighty-seven individual industries ranging from iron and steel making to ice-cream manufacture. This sheet is one of the most ambitious attempts to depict the distribution of industry that has been included in any national atlas, and as such must be regarded as a reference of primary importance. The accompanying commentary[5] gives a general outline of manufacturing in Australia but, reflecting the lack of published research, does not analyse in any detail the reasons for its present distribution. It is advantageous to view the map and commentary in conjunction with the rest of the Atlas; for instance, the maps, 'Forest Resources' and 'Mineral Industry', give a great deal of information about raw material sources and supplies, and those of 'Power and Fuel' and 'Railways' provide an insight into some of the factors of location.

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[1] Grateful acknowledgement is made to Mr T. Plumb and Mr L. Hazlewood of the Departmen of National Development, Canberra, for a number of helpful suggestions.

[2] Commonwealth Bureau of Census and Statistics, *Secondary Industries Bulletin*, Canberra published annually.

[3] *New South Wales Statistical Register*, *Victorian Year-Book*, *Queensland Year Book*, *South Australi Statistical Register*, *Statistical Register of Western Australia* and *Statistics of the State of Tasmania* all now published annually by the Commonwealth Bureau of Census and Statistics.

Department of National Development: 'Manufacturing Industries', *Atlas of Australian Resources* Canberra, 1960.

OTHER GENERAL REFERENCES

A work which can only be described as encyclopaedic in style and content is *The Structure and Capacity of Australian Manufacturing Industries*.[6] Aiming to give a consistent body of information, each of the seventeen chapters deals with a group of associated industries under the headings: 'Structure of Established Manufacturing Industries', 'Outline of Capacity of Manufacturing Activities', and 'Basic Statistics', but, unfortunately, contains little or no discussion of industrial location. Developments taking place since it was published in 1952 can be traced through two other official periodicals: the *Survey of Manufacturing Activity in Australia*[7] which consists of a general summary and a series of reports on selected industries, and *Developments in Australian Manufacturing Industry*[8] which contains a succinct paragraph about each of the known projects planned or in progress involving an expenditure of at least £A50,000.

Apart from these official surveys there are only a few others that consider general aspects of manufacturing in Australia. A recent study by Davidson[9] deals briefly with the history, recent changes, and present structure of secondary industry, and concludes with a useful section devoted to 'hopes, questionings and results'. In this pamphlet little mention is made of the location of manufacturing, but elsewhere[10] the same author has used Sargant Florence's 'location factor' technique to point up industries that are particularly concentrated in some states. Andrews[11] has produced an excellent short description of the distribution of manufacturing between the states and, in a town and regional planning context, Brown and Sherrard[12] devote a chapter to a general discussion of industrial location with particular reference to Australia.

STUDIES OF INDIVIDUAL INDUSTRIES

In recent years a considerable volume of material has appeared dealing with individual manufacturing industries. An extremely useful 'industry study' series was commenced by the Department of Trade in 1958, and this includes, so far, reports[13] on copper, hard fibreboard, plastics, steel, builders' hardware, motor vehicles, earthmoving and construction equipment, agricultural machinery, packaging, pharmaceutical products and aluminium. Each of these is an invaluable source of up-to-date information on the structure of the industry, on the supply and demand for its products, on raw materials, and on relevant government policies. There are a number of other studies of individual industries,[14] some of which are by geographers, and, in addition, a few large firms have published, or have been the subject of, books and brochures.[15]

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[5] *Manufacturing Industries*, a commentary prepared by the Industries Division, Department of Trade, for the Department of National Development, Canberra, 1959, pp. 22.

[6] Published by the Division of Industrial Development in the Department of National Development (now the Industries Division of the Department of Trade), Melbourne, 1952, pp. 528.

[7] Published by the Industries Division of the Department of Trade, Melbourne, annually (half-yearly from 1952 to April 1958).

[8] Published by the Industries Division of the Department of Trade, Melbourne, annually.

[9] F. G. Davidson: *The Industrialization of Australia*, Melbourne, 1957, pp. 26.

[10] *idem*: 'Geographical Specialisation of Manufacture in Australia', *Economic Monograph No. 6*, Victorian Branch of the Economic Society of Australia and New Zealand, July 1957, pp. 10.

[11] J. Andrews, *Australia's Resources and their Utilisation*, Part 2, Department of Tutorial Classes, University of Sydney, 1956, (revised edition) pp. 33-42.

[12] A. J. Brown and H. M. Sherrard, *Town and Country Planning*, Melbourne, 1951, pp. 331-344.

Individual Area Studies

Much of the information about manufacturing activities in individual states, regions, or towns appears in regional-resource or town-planning surveys. In 1944 the governments of the commonwealth and states agreed that it would be desirable to plan future development on a regional basis. With this in mind some state authorities have prepared a considerable number of regional surveys, most of which contain sections on secondary industry.[16] Two states have published atlases which include sheets showing the distribution of factories and factory employment but, unlike the Tasmanian production[17] which is now in its third edition, the Victorian publication[18] is out of date. The resources of the Murray Valley have been surveyed, and th published report[19] contains information about secondary industry set out in bot text and maps.

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[13] *The Australian Copper Industry*, March 1958; *Manufacture of Hard Fibreboard in Australia*, April 1958; *Plastics Industry of Australia*, May 1958; *Steel Industry in Australia*, November 1958, (second edition); *The Australian Builders' Hardware Industry*, January 1959; *The Australian Motor Vehicle Industry*, March 1959; *The Australian Excavating, Earthmoving and Allied Construction Equipment Industry*, March 1959; *The Australian Agricultural Machinery and Implemen Industry*, April 1959; *The Australian Packaging Industries*, January 1960; *The Australian Pharmaceutical Products Industry*, January 1960; *The Australian Aluminium Industry*, May 1960.

[14] See, for example, C. M. Zierer: 'Broken Hill: Australia's Greatest Mining Camp', *Annals Assoc. Amer. Geogrs.*, Vol. 30, 1940, pp. 83-108; N. R. Wills: *Economic Development of the Australian Iron and Steel Industry* (mimeographed), June 1948, pp. 198; *idem*: 'The Growth of the Australian Iron and Steel Industry', *Geog. Journ.*, Vol. 115, 1950, pp. 208-218; 'The World's Cheapest Steel', *Fortune*, Vol. 42, November 1950, pp. 83-89; O. H. Woodward: *A Review of the Broken Hill Lead-Silver-Zinc Industry*, Melbourne, 1952, pp. 400; P. Scott: 'An Aluminium Industry in Tasmania', *Geography*, Vol. 40, 1955, pp. 128-130; 'Aluminium', *Current Affairs Bulletin*, Vol. 26, No. 1, 1960, pp. 16; P. Scott: 'The Australian Motor Vehicle Industry', *Geography*, Vol. 44, 1959, pp. 208-210; M. B. Dale, 'The Location of Oil Refineries in Australia', *N.Z. Geographer*, Vol. 15, No. 2, October 1959, pp. 160-172; and H. E. Laffer: *The Wine Industry of Australia*, Adelaide, 1949, pp. 136.

[15] Examples are, Broken Hill Proprietary Co. Ltd.: *Steel in Australia*, [n.d.], (c. 1957), pp. 56 Mount Isa Mine Ltd., *Summary of Operations, 1958*, [n.d.], (c. 1960), pp. 58; The Zinc Corporation Ltd. and New Broken Hill Consolidated Ltd., Zinc Corporation, 1948, pp. 90 G. Blainey: *The Peaks of Lyell* (the Mt Lyell Mining and Railway Company), Melbourne 1959 (second edition), pp. 310; A. G. Lowndes (ed.): *South Pacific Enterprise*, (The Colonia Sugar Refining Co. Ltd.), Sydney, 1956, pp. 500. See also numerous trade journals.

[16] The New South Wales Premier's Department published 21 surveys between 1945 and 1953 and the Victorian Central Planning Authority eight surveys by 1948. See also A. M. Kerr: *The Resources and Development of the South West Region of Western Australia*, (2 vols.), Apri 1955, pp. 317; and *Western Australia Industry-Commerce Facts and Figures*, Perth, 1954, pp. 152

[17] The Directorate of Industrial Development: *Regional Planning Atlas, Economic Resources o Tasmania*, [n.d.] (third edition c. 1954).

[18] Victoria State Regional Boundaries Committee: *Report on Regional Boundaries*, 1944, Appendix III, 'Maps'.

[19] Department of National Development: *Report of the Murray Valley Resources Survey Committee*, (2 vols.), Canberra, 1947.

Discussions of various aspects of manufacturing on a state basis include that by Stevens[20] on Victoria; that by Vargovic[21] on Western Australia; and those by Hirst[22] and Thomson[23] on South Australia.

Most town-planning reports contain sections on secondary industry, but those dealing with Melbourne[24] and with Perth-Fremantle[25] are examples from which other town planners and geographers alike can obtain many useful ideas. In a number of studies of particular urban areas there is some discussion of manufacturing,[26] and although a few writers have made industry in towns the main purpose of their discussions,[27] only Holmes[28] has attempted a geographical analysis (of Metropolitan Sydney in 1947) by using detailed dot maps to show the distribution of various kinds of manufacturing.

NON-METROPOLITAN INDUSTRY

Only limited progress has been made with somewhat modest attempts since the second World War to foster industrial development at inland towns and so reduce the concentration of productive resources along a narrow coastal strip and, especially, in the capital cities. This policy was the subject of a series of papers[29] and is briefly but sensibly discussed in a recent bank publication.[30] Some of the difficulties faced by the authorities and manufacturers alike in establishing secondary industry inland are illustrated and analysed in two reports[31] commissioned by the New South Wales Government dealing with the City of Greater Cessnock and with Lithgow. An interesting approach which bears on this problem has been made by Clark[32] who has attempted to analyse the ability of towns of various sizes to provide their own and surrounding inhabitants with a desirable range of economic activities. A study of country towns in Victoria[33] is essential reading for an understanding of the economic and social life of the smaller inland Australian settlements.

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[20] S. P. Stevens: 'Manufacturing Industry in Victoria', in G. W. Leeper (ed.): *Introducing Victoria*, Melbourne, 1955.

[21] C. A. Vargovic: *A Survey of Structural Changes in the Western Australian Economy*, Perth, 1956, pp. 36-67.

[22] R. Hirst: 'Secondary Industries in South Australia—Recent Employment Trends, 1923-1948', *Proc. Roy. Geog. Soc. of S. Aust.*, Vol. 50, 1948-1949, pp. 47-60.

[23] K. W. Thomson: 'Secondary Industry', in R. J. Best (ed.): *Introducing South Australia*, Melbourne, 1958.

[24] 'Secondary Industry', in E. F. Borrie: *Melbourne Metropolitan Planning Scheme 1954—Surveys and Analysis*, Melbourne, 1954.

[25] 'Manufacturing Industry', in G. Stephenson and J. A. Hepburn: *Plan for Metropolitan Region and Fremantle Report*, 1955.

[26] C. M. Zierer: 'Melbourne as a Functional Center', *Annals Assoc. Amer. Geogrs.*, Vol. 31, 1941, pp. 251-288; *idem* 'Industrial Area of Newcastle, Australia', *Econ. Geog.*, Vol. 17, 1941, pp. 31-49; *idem:* 'Brisbane—River Metropolis of Queensland', *ibid.*, pp. 325-344; E. M. Bjorklund: *Focus on Adelaide*, University of Chicago Department of Geography Research Paper No. 41, Chicago, 1955, pp. 133; P. Scott, 'Hobart: An Emergent City', *Aust. Geogr.*, Vol. 6, No. 4, January 1955, pp. 19-31. See also, 'Industry', in *The Planning Scheme for the County of Cumberland, New South Wales*, Sydney, 1948, pp. 226.

[27] K. Taylor: 'Geelong—The "Bradford" of Australia', *Regional Development Journal*, Vol. 2, No. 5, June 1952, pp. 294-299; J. Loughlin: 'City of Steel' (Wollongong, New South Wales), *ibid.*, Vol. 2, No. 4, November 1951, pp. 208-218; J. B. Rowe: 'Whyalla—A Study of Geography in the Making', *Aust. Geogr.*, Vol. 5, No. 7, June 1948, pp. 176-182; N. R. Wills: 'Yampi Sound, Industry's New Frontier', *National Development*, No. 2, December 1952, pp. 16-25; *Newcastle: Industrial Capital of Australia*, Newcastle, 1947, pp. 60.

[28] J. Macdonald Holmes: 'Factory Orientation in Metropolitan Sydney', *Aust. Geogr.*, Vol. 5, No. 5, June 1947, pp. 96-113.

[29] H. L. Harris *et al.*: *Decentralization*, Sydney, 1948, pp. 204. See also T. H. Halsey: *Decentralization—Its Social and Economic Considerations*, Canberra, 1949, pp. 99.

[30] Australia and New Zealand Bank Ltd.: 'Decentralization of Industry', *Quarterly Survey*, October 1959, pp. 11-13.

[31] Personnel Administration Pty. Ltd.: *Industrial Survey of Greater Cessnock*, 1960, pp. 89; W. D. Scott & Co. Pty. Ltd.: *Survey of the Industrial Opportunities of the City of Lithgow*, 1960, pp. 38

Factors of Location

The costs and problems of freighting raw materials and finished products is the key which explains much about the location of manufacturing in Australia, and a group of conference papers published by the Australian Institute of Political Science[34] gives an insight into some of the main difficulties faced by the various forms of transport in this country. Among other papers on this subject[35] a short note by Reeves[36] analyses freight costs and the location of secondary industry in Victoria and illustrates, by taking the case of bed-sheet manufacture, the marketing advantages to be gained by a capital-city location.

Fuel and power resources are discussed in another publication[37] of the Australian Institute of Political Science. In addition, Elford and McKeown[38] have described the coal industry in Australia, and Mauldon[39] has analysed the changing status of coal in the economy of the commonwealth.

There are, of course, many other studies on various aspects of industrial development with which geographers should be familiar, but there is space here to mention only the work of Maizels[40] on productivity, and of Dowsett[41] on spatial competition and sheltered industries with particular reference to Western Australia.

The rapid growth of Australia is attracting a considerable amount of oversea capital, and the extent to which local firms are associated with parent companies abroad can be seen from a series of surveys published by the Industries Division of the Department of Trade[42] listing British, United States and Canadian manufacturing interests in Australia, and from a study by Wheelwright.[43] The Manufacturing Industries Advisory Council, formed by the Minister of Trade in 1958, has also set out its views on investment in the commonwealth.[44] This same council has drawn attention to the role which secondary industry will have to play in the future;[45] it points out, for instance, that the total Australian workforce will reach about 5,300,000 by 1970 and, on the assumption that manufacturing continues to employ the same proportion as at present, factory jobs will have to be found for 400,000 more persons during the next decade. But, as in New Zealand, not everyone is agreed about the extent to which secondary industry should be encouraged, and Clark's views[46] on this subject provide food for thought and discussion.

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[32] C. Clark: 'The Economic Functions of a City according to its Size', *Econometrica*, Vol. 13, 1945, pp. 97-113; and *idem:* 'The Distribution of Labour between Industries and between Locations', *Land Economics*, Vol. 26, 1950, pp. 136-144.

[33] A. J. & J. J. McIntyre: *Country Towns of Victoria, A Social Survey*, Melbourne, 1944. See especially Chapter 4, 'Manufacturing Industries', pp. 70-84.

[34] John Wilkes (ed.): *Australia's Transport Crisis*, Sydney, 1956, pp. 215.

[35] T. Hytten: 'Some Problems of Australian Transport Development', *Economic Record*, Vol. 23, 1947, pp. 5-19; C. P. Haddon-Cave: 'Transport Costs and the Decentralization of Secondary Industry', *Australian Quarterly*, Vol. 19, No. 4, December 1947, pp. 103-111; R. R. Hirst: 'Interstate Road Transport', *Economic Record*, Vol. 32, 1956, pp. 273-290.

[36] J. H. Reeves: 'Transport Costs and the Location of Industry in Victoria', *Economic Record*, Vol. 27, 1951, pp. 231-236.

[37] H. R. Wills (ed.): *Australia's Power Resources*, Melbourne 1955, pp. 149. See also *The Supply and Usage of Energy in Australia*, Canberra, 1958, pp. 41.

[38] H. S. Elford and M. R. McKeown: *Coal Mining in Australia*, Melbourne, 1947, pp. 248. See also P. L. Henderson (ed.): *Brown Coal—Its Mining and Utilization*, Melbourne, 1953, pp. 351.

[39] F. R. E. Mauldon: 'The Changing Status of Coal in the Australian Economy' in *The Past, Present and Future of Australian Power Supplies*, Melbourne, 1947.

[40] A. Maizels: 'Trends in Production and Productivity in Australian Manufacturing Industries', *Economic Record*, Vol. 33, 1957, pp. 162-181; and *idem:* 'Comparative Productivity in Manufacturing Industry, A Case Study of Australia and Canada', *ibid.*, Vol. 34, 1958, pp. 67-89.

[41] W. T. Dowsett: 'Spatial Competition and Sheltered Industries', *ibid.*, Vol. 33, 1957, pp. 72-79.

[42] *British Manufacturers in Australia*, 1959; *United States Investment in Australian Manufacturing Industry*, 1960; *Canadian Companies associated with Australian Manufacturing Industry*, 1959.

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[43] E. L. Wheelwright: *Ownership and Control of Australian Companies*, Sydney, 1957, pp. 206.

[44] *Oversea Investment in Australia*, Sydney, 1960, pp. 36.

[45] *Australian Manufacturing in the Next Decade*, Sydney, 1959, pp. 42.

[46] C. Clark: *Australian Hopes and Fears*, London, 1958, pp. 322.

GEOGRAPHIC NOTEBOOK

IN THIS ISSUE. A generation ago, in April 1938, the Esk River flooded, and over many square miles of the Hawkes Bay hill country pasture land slid away like 'snow from roofs'. Thousands of acres went out of production. Today most of the scars have healed and the silt has disappeared, and, to many, soil erosion now seems to be something of the remote past—an unenlightened past which could not recur. Yet recent floods in the valleys of the Waikato and Waipa, and in those of the Waihou and Piako, emphasise that the danger remains and that the best remedy is prevention. In this vein Mr A. L. Poole, Assistant Director of Forestry, makes his plea for protection forest in New Zealand, drawing an example from Poverty Bay where soil erosion and flooding have been characteristic and where the reafforestation of the Waipaoa catchment has just begun.

In the urban scene also there have been changes during the last twenty-five years. In the four main centres of New Zealand, as in many other parts of the world, today and in the past, a progressive decline of the city core as a residential area has become apparent, and in his article Mr R. J. W. Neville presents an interpretation of this phenomenon in the case of the city of Wellington. Mr Neville, who was with the Town and Country Planning Branch of the Ministry of Works, is now Lecturer in Geography at the University of Malaya in Singapore.

The work of Mr G. R. Cochrane, who was recently appointed Senior Lecturer in Geography at the University of Melbourne, is well known to readers of the *New Zealand Geographer*. His present contribution on the geography of the Winton district is the outcome of fieldwork first begun when he was an Assistant Lecturer in the University of Otago. Miss Dinsdale's account of the changing patterns of settlement in Tauranga county is an adaptation of part of her thesis presented for a masterate degree when a student in the Department of Geography at the University of Canterbury. Miss Dinsdale is now pursuing postgraduate studies at Syracuse, New York, under Preston James.

The fifth article in this number of the *New Zealand Geographer* has been written by Mr J. W. Macnab, Lecturer in Geography at the Victoria University of Wellington. Mr Macnab's contribution may be regarded as complementary to that of Mr F. H. Bishop which appeared in the *New Zealand Geographer*, Volume 9, Number 2, October 1953.

Notes, commentaries and reviews in this issue have been prepared by Dr G. J. R. Linge of the Australian National University at Canberra, his contribution being a review article on the literature of manufacturing in Australia; Professor K. B. Cumberland, Mr B. H. Farrell, Mr E. J. Searle, Mr R. G. Ward and Mr J. S. Whitelaw of the University of Auckland; Professor G. Jobberns and Mr W. P. Packard of the University of Canterbury; Mr R. G. Lister, Mr W. J. Brockie and Mr R. P. Hargreaves of the University of Otago; Mr V. F. Fisher of the Auckland Institute and Museum; Mr J. L. Hewland and Mr L. S. Suggate of Christchurch; Mr G. R. Cochrane; and the editors.

THE FIRST AMONG US. With the retirement earlier this year of Professor George Jobberns from the Chair of Geography in the University of Canterbury an epoch in the history of the study and teaching of geography in New Zealand came to an end. Dieffenbach, von Hochstetter and von Haast represent an era, from 1840 to 1870, in which the New Zealand scene was committed to writing by scientific travellers in the established Humboldt tradition, after which geography in the colony too often reverted to an idle and empty cataloguing of bald physical and economic facts. In this form it remained in the schools, but lost all respect in the higher strata of the educational and scientific life of the country.

Earlier this century geography in New Zealand was partly rescued from this useless and unhappy state by a small number of geologists, historians and economists. Starting with Marshall, they also included Benson, Cotton, Bartrum and Hight, and it was occasionally taught by them in separate and dichotomous parts in first-year university courses. Its establishment in the university in the late 1930's as a fully-fledged and unitary discipline, and later in the schools as almost the most popular subject, was above all the work of another geologist—in his own inimitable and modest words 'a geologist gone bad'—George Jobberns. When he was appointed to the first Chair of Geography in the University of New Zealand, at Canterbury University College in 1941, he became in function and status the New Zealand counterpart of Carl Ritter and Sir Halford Mackinder whose task it also had been to gain wide acceptance for their subject in educational circles, in the scientific world, and in popular esteem.

It was as a teacher, and later as a trainer of teachers at the Christchurch Teachers' College, officially as 'lecturer in physiography', that George Jobberns became convinced of the need for the reform and extension of geography teaching in the schools, and of the importance, if this was to be achieved, of the establishment of both teaching and research in geography in the four university colleges of the University of New Zealand. In the twenty-odd years after his first appointment to a lecturership in geography at Canterbury College, and before his retirement, all this was accomplished, very largely as a result of his own efforts, example and enthusiasm.

It took a man of special qualities—special qualities which Professor Jobberns has had in abundance. It required scholarship. It demanded personal conviction and the ability to convince others. It required sympathy, tolerance and political acumen. Moreover, the man to undertake this task had himself to be an expert teacher, a first-rate geographer and a capable administrator.

Professor Jobberns demonstrated his scholarly qualities as a geologist and geomorphologist in his work on New Zealand shorelines. His experience as a teacher, in primary and post-primary schools and later in a teachers' training college and at the university, has been long and varied. Testimony to his abilities in this field is borne by a whole generation of countless former pupils and students throughout the world. They will always remember his simple, entertaining, but impressive, teaching methods, his kindly effervescent and infectious humour, his telling use of endless personal anecdotes and reminiscences, his tolerance, and his ever-ready sympathy, especially for the struggling 'part-timer'.

The task he voluntarily assumed also demanded tact. Professor Jobberns's success in his negotiations with university and educational authorities reveals his skills as tactician and diplomatist. But above all it demanded a man of genial personality, of catholic tastes and of broad and liberal views. Few geologists have the range of interests exhibited by Professor Jobberns and this made him from the start as good a geographer as he was geologist and geomorphologist. His qualities as teacher and geographer have been recognised in the rare distinction he enjoyed in twice being chosen as a Carnegie Travelling Fellow, and by his university in appointing him Professor Emeritus.

His interests are amply revealed also in his many non-academic activities. For over fifteen years he has served the people of Canterbury as a member of the North Canterbury Catchment Board, and has long been chairman of the Avonside Girls' High School Board of Governors. And George Jobberns—as a member of the Canterbury Club—is a snooker player of unexpected merit. He is also a bowler of no mean prowess.

His chief loves—outside his family—have almost always been teaching and the landforms, landscapes and countryside of New Zealand, and particularly of the Canterbury High Country. These deep interests have enabled him in manifold ways to render to all of them invaluable service. In doing so he has earned the admiration, respect and gratitude of many people—not least of his former pupils, students and colleagues—and all will, whilst regretting his retirement, wish him many more years of happy and more leisurely, but continued, service to his fellows.

—KENNETH B. CUMBERLAND

GEOGRAPHERS IN THE UNIVERSITY. The last occasion on which reference was made in this journal to staff changes in the various university departments of geography was October 1958. Since then much has happened, the most notable event being the retirement, in May 1960, of Professor George Jobberns, M.A., D.Sc., from the Chair of Geography at the University of Canterbury. To George Jobberns geographers in New Zealand owe much, and they hope that, despite his withdrawal from the active academic scene, he will always be at hand—to prompt, as it were, and to give to those who follow something of his learning, his wit and his understanding.

The successor to Professor Jobberns is Dr L. L. Pownall, a former student of Canterbury University College, who was Senior Lecturer in the department at the time of his appointment. The Visiting Lectureship at the University of Canterbury was filled in 1959 by Dr H. J. Critchfield of Western Washington College, Bellingham, and in 1960 has been filled by Dr L. Symons of Queen's University, Belfast. Mr. W. P. Packard has been promoted to the status of Senior Lecturer, and two appointments have been those of Dr Jane M. Soons and Dr L. J. King to lecturerships. Dr Soons, whose specialist interest is in geomorphology, is a graduate of the universities of Sheffield and Glasgow, and Dr King is a graduate of Canterbury who has been pursuing research in economic and urban geography for the past three years in the University of Iowa. Dr G. R. Linge, a former postgraduate research student at Canterbury, is now at the Australian National University in Canberra.

During 1959 Mr R. G. Lister, Head of the Department of Geography at the

University of Otago, was away in Britain on study leave. His place was taken by Professor D. L. Linton of the University of Birmingham who occupied the William Evans Visiting Professorship. Mr R. P. Hargreaves has been promoted to a lecturership, whilst Mr P. N. D. Pirie resigned his post at the end of 1959 in order to take up a research scholarship in the Australian National University. In his stead Mr J. Forrest, a Canterbury graduate, has been appointed as Assistant Lecturer.

At the Victoria University of Wellington Mr H. Franklin was also on study leave in Europe during 1959, and since his return he has been promoted to the status of Senior Lecturer. Mr J. W. McNab has been appointed Lecturer in Geography after acting in a temporary capacity. Mr McNab returned to New Zealand in 1959 after teaching in Pakistan and undertaking research work at King's College, London. A further addition to the staff was Mr D. I. Pool, who graduated at the University of Auckland in 1959. Mr Pool, who is Junior Lecturer, took the place of Mr McGee who left to take up an appointment in the University of Malaya at Kuala Lumpur. Palmerston North University College was opened in 1960 as a branch of the Victoria University of Wellington, and the two lecturerships there were filled by Mr B. Saunders of North Staffordshire and Adelaide, and Mr E. Warr, a former Canterbury student who completed his masterate at the London School of Economics.

Staff changes have also characterised the Department of Geography at the University of Auckland. Dr G. R. Lewthwaite left to take up a post as Associate Professor at the San Fernando State College, California, whilst Dr L. Curry, also bound for the United States, departed for an extended leave in Europe before proceeding to the University of Maryland as Assistant Professor. During the academic year 1958-1959 Mr R. G. Ward was at University College, London pursuing his investigations into land and resource problems in Fiji under the aegis of the Colonial Office. On his return he was appointed to a lecturership. Other vacancies on the staff have meantime been filled by Dr Marion Ward, a former student in the department and a graduate of Auckland and the University of Minnesota, and by Mr M. Chapman, who is completing his masterate in 1960. During 1959-1960 Mr B. H. Farrell was on study leave in American Samoa investigating land-use and related problems, whilst in August 1960 Professor K. B. Cumberland attended the XIXth International Geographical Congress at Stockholm.

Other noteworthy events were the visit of Dr J. S. Duncan, a Canterbury graduate, now of the University of Manchester, who was Visiting Lecturer at the University of New England, Armidale, N.S.W., in 1960, and the appointment of Mr R. J. W. Neville to the staff of the University of Malaya at Singapore.—THE EDITORS.

NEW GEOLOGICAL MAPS OF NEW ZEALAND. The recent publication of several new series of geological maps of New Zealand compiled by officers of the New Zealand Geological Survey, Department of Scientific and Industrial Research, is worthy of note. Sheets in the new series which have been issued to date include, first, the Geological Map of New Zealand, 1 : 2,000,000, which was published in March 1958. The single sheet of approximately thirty-six by twenty-four inches covers the three main and outlying islands. The map is printed in twenty colours which, with overprinted symbols, permit the differentiation of forty mapping units.

The legend and printing are clear and legible, and in spite of the relatively small scale, the map presents a surprising amount of detail. It differs from the geological map published in 1947 mainly in the closer subdivision of pre-Mesozoic sedimentary rocks and in the inclusion of many new igneous and metamorphic units—in all, forty rock units as compared with twenty-three in the older edition.

The map was followed by the publication, in 1959, of a bulletin, (*N.Z.G.S. Bulletin No. 66*, n.s.) bearing the same title. A useful introduction surveys geological maps of New Zealand published during the past hundred years. The remaining chapters are of interest only to geologists and are concerned with outlining advances in mapping since the 1947 edition and in validating stratigraphic names not previously defined in the publications of the survey.

Secondly there has appeared a new series, the Geological Map of New Zealand, 1 : 250,000. This is to be completed in twenty-seven sheets, of which three have so far been issued: Sheet 10, Wanganui, and Sheet 21, Christchurch, both in 1959, and Sheet 27, Fiord, in 1960. Each of these maps has a full formational legend set out in a broad right-hand margin and, in the left, a brief description of the geology of the area together with a selected bibliography. They will prove to be of great interest, not only to geologists and geographers, but also to travellers with an intelligent interest in the country through which they are moving.

Thirdly there is the Geological Map of New Zealand: 1 : 63,360. For the time being this series will be limited to maps of areas of particular interest. Only one sheet has yet been issued, that of N85, Waiotapu, compiled by G. W. Grindley and published in July 1959. Marginal printing provides a geological section, explanatory notes on landforms, structure, stratigraphy and economic geology, and a useful bibliography.

The Director of the Geological Survey, his officers—especially the chief draughtsman, Mr C. T. T. Webb—and the Government Printer are to be congratulated on these additions to the library of New Zealand maps.—E. J. SEARLE

PROBLEM AND PROSPECT IN FIJI. The crux of Fiji's problem is the balance of land and people. On the face of it there is too little land and too many people, and eight years ago, the Legislative Council, 'gravely perturbed', urged the appointment of a commission of enquiry. In 1959 a commission of three—Sir Alan Burns, former colonial administrator, Professor A. T. Peacock, economist from Edinburgh, and Mr T. Y. Watson, agricultural scientist with tropical colonial experience—was appointed to survey the information on the population and resources of Fiji and to say how the development of the colony should proceed so as to maintain good standards of living for all sections of the multiracial community.

The report of this highly-qualified and admirably-balanced commission has been published as Council Paper No. 1 of 1960 of the Legislative Council. It has been labelled 'blunt' and 'bold', perhaps mainly because, without much discussion, it firmly asserted the need for birth control by Indians, Fijians and Europeans alike. It is a direct, and sometimes harshly critical—even caustic—report. It contains 124 separate recommendations which, the commission says, may well be unpalatable medicine, but which must be swallowed at a gulp. The report demands that they be all accepted and implemented.

This could, however, be dangerous, for no commission is infallible. Fiji itself must take the decisions for its own fate and future, and there are people on the spot—officials, businessmen, planters, Fijian village chiefs and Indian politicians and artisans—capable of deciding, now that the position is laid bare, which of the remedies prescribed will be most acceptable, and whether they can be refined and added to.

The report points out that the average *per capita* income in Fiji is approximately £NZ60 a year; that the population, totalling 198,000 in 1926, is now over 400,000, and will reach half a million in six years; that the crude death rate has been reduced to 7 per 1,000 and is one of the lowest on earth; and that agriculture provides half of the net income of the economy, agricultural products furnishing over four-fifths of all exports. Since the war, and probably for twenty years, crop production has been static. This means that *per capita* volumes of production have meanwhile fallen by half.

All and sundry are blamed for this situation—all, perhaps, but the Indian majority of Fiji's population. Even the Colonial Sugar Refining Company, usually absolved from blame for Fiji's problems, is criticised for concentrating effort on production as distinct from husbandry. The government is accused of extravagance and of failing to sense the urgency of economic development. The Department of Agriculture is at fault for its tardiness, its failure to act on advice, and its lack of a broad policy of agricultural expansion. Yet the report says too little has been spent on agriculture and too much on health measures and education.

However the most severe criticism and castigation is reserved for, first, the financial waste and burden of supporting a separate Fijian administration, especially since it is charged with two incompatible responsibilities, the welfare of the Fijians and the preservation of their traditional way of life; second, a paternalistic government's outmoded clinging to the Fijians' communal organisation which denies them individual freedom and which is responsible for their isolation, lack of initiative and despair at their own capacity to compete in a modern system; and, third, the institutional arrangements related to Fijian custom which in effect withhold usable land from use.

The commission's analysis of the facts and its conclusions are shrewd and pertinent. Its language may be plain and blunt, but its recommendations are hardly bold or big enough to match the problem revealed or the criticism levelled.

A damning case is built up against the 'dual' form of administration which treats Fijians separately under an elaborate system of indirect provincial and local government that overlaps with the central government, duplicates services, and yet fails to cooperate with the technical agencies of central government. The Fijian administration also relies on an inadequate coterie of capable Fijians of chiefly rank. They are at one and the same time too few in number, too powerful and too heavily burdened with work and responsibility. Yet Sir Alan Burns and his colleagues, whilst stating clearly that the separate Fijian administration should go, content themselves with suggesting a few changes in official titles, a shift of accommodation for the Fijian Affairs Department, and adjustments of minor administrative details.

Similarly the Fijian communal system—thoroughly outdated and maintained 'against the wishes of a large number of people'—is to be left intact. The commission does little to obviate the situation it so roundly condemns. It does make one very penetrating statement when it says 'customs and culture are of their essence changeable, and those that are truly alive and viable [alone] will survive'; yet, apart from admonishing the Fijians, the report makes no proposals for easing the effects of the tide of change. It leaves the hampering and outmoded system as it was.

But access to land is the key. Eighty-three percent of all land is held under native customary tenure and has been guaranteed since 1874 to the Fijians. Six percent is crown land and less than ten percent freehold. The Fiji Indians, comprising more than half the population, have access to no more than nine percent of all the land, often under unsatisfactory short leases which encourage overuse and misuse. Here is the real dilemma. The report suggests, naturally enough, the early demarcation of areas of Fijian reserves, the extension of the term of leases to sixty years (ninety-nine years in the case of tree crops), the registration of *mataqali* (Fijian land-holding units), and a form of tenure equivalent to freehold so that Fijian groups may pledge land as security for loans to be used to develop production.

However, the commission recommends a new system of heavy penal taxes on land which is inadequately used. This is to apply to all land whether freehold or communally held, and even to the still-to-be-demarcated reserves after five years. This is essentially a negative and punitive approach. The commission mentions only two possible methods of taxation. One it itself describes as 'cumbersome', and the other as 'arbitrary'. The Director of Agriculture is to have the unenviable job of saying what land is 'capable of being used yet not adequately used'. This means an army of surveyors and agricultural inspectors as well as tax gatherers. The proposal would appear to be quite impracticable.

This proposal is all the more surprising in view of the commission's rejection of the submissions that some public or semipublic agency should be designed to develop unused land. Had the commission had some experience of the postwar success of the Departments of Lands and Maori Affairs in New Zealand in bringing land into production and in settling farmers on it this propesal might not have been passed off by the suggestion that land development can 'be carried out more cheaply by farmers themselves' and that they 'would prefer' large projects to be handled by private companies. In a country where capital skills and technology are so short and development is at a standstill there is strong case for official planning and development of resources and for the state-aided settlement of unused land.

Fifty pages of the report are devoted to agriculture. This is an admirable, clear and objective summary, and includes some rather harsh references to the Department of Agriculture, and harsher criticism of the failure of Fijian villagers and of private planters to plant and replant coconuts and to take adequate care in the preparation of copra. There are thirty recommendations on agricultural policy, planning and education. Many of them have been discussed in Suva for many years. They relate to weaning farmers from sugar cane (sugar output is in excess of the amount that can be disposed of under international arrangements); to subsidising coconut planting; to the establishment of tree crops such as cocoa, coffee and tea; to mixed farming and more livestock; to large-scale cattle ranching; and to farm training and agricultural extension.

The rest of the report relates to conservation and land drainage, to minerals, tourism, transport, trade and timber. Industries are dismissed very briefly and little importance is attached to them as a solution to the problems of the colony.

Despite its weaknesses the report provides the basic facts and clears the hitherto confused deck for action. But it will require a mighty and concerted effort by all Fiji's communities to achieve increased and permanent prosperity. New Zealand will watch their efforts with interest and sympathy—and may well be able to help if required.—KENNETH B. CUMBERLAND.

KANGAROO ISLAND GYPSUM PROJECT. The plans already announced for the building of a deepwater port at American Bay and for the large-scale exploitation of gypsum deposits on Kangaroo Island should do much to boost the economy of the American Bay area of Kangaroo Island. Test piles driven at Ballast Head, on the western headland of American Bay, in June 1959 were the first step in the plans to construct a 300-foot wharf with mechanised bulk-loading facilities for the handling of gypsum mined near the south coast. The site chosen for the sheltered deepwater port is only fourteen miles from the large high-quality gypsum deposits, and a new road will link the port and the mining area.

South Australian gypsum deposits are the most important in Australia, supplying fifty-six percent of Australian production. The main output in South Australia is at present from Stenhouse Bay on Yorke Peninsula and from Lake McDonnell. The Kangaroo Island deposits are 350 miles closer to Sydney—a major market—than are those at Lake McDonnell.

Mining is very simple. The Kangaroo Island deposits, amounting to over two million tons, are to be mined from the bottom of a shallow inland lake by large-scale, efficient opencast methods very similar to those employed at the Kimihia opencast mines at Huntly. Bulk storage and mechanical loading at the port will further contribute to the efficiency and low cost of mining. Until the present, small-scale methods have been employed. The gypsum has been recovered by mechanical dragline and transported by small ketch from the American River to Port Adelaide.

Much of this gypsum will be shipped to Sydney to be used in the manufacture of plaster sheets, plaster wallboard, plaster acoustic tiles, plaster, and other allied building products. Some will be used in cement manufacture and small amounts incorporated in fertilisers. Future expansion of the high-quality Kangaroo Island deposits seems assured as they have produced the best gypsum for plaster making in Australia, and considerable quantities are exported to New Zealand for its plaster industry. Gypsum is also exported to New Caledonia for use in nickel-smelting operations.

—G. ROSS COCHRANE

WATER STORAGE PLAN FOR SOUTH AUSTRALIA. Plans to build, on the River Murray, the largest dam in Australia are actively under way. The future progress of South Australia depends largely upon the magnitude of its water resources, and its only large permanent source of water is the River Murray.

Under the River Murray Waters Agreement the River Murray Commission controls the amount of water available to New South Wales, Victoria and South Australia. The *minimum* quantity of water allowed for South Australia is 1,254,000 acre-feet annually, providing that there is a flow varying from 47,000 acre-feet per month in the winter months to 134,000 acre-feet per month in the four summer months of maximum demand. To date these quantities have been sufficient for requirements, but the demand for water for domestic, irrigation and industrial purposes is increasing so rapidly that it is quickly overtaking the short supply.

Since 1939 the average annual flow of the River Murray to South Australia has been over nine million acre-feet, but the minimum flow has been as low as 760,000 acre-feet. It is this minimum flow and not the average that limits development. Over this same period maximum flow has been as high as thirty-nine million acre-feet. Even with the increased water storage gained when the Hume Reservoir enlargement is completed and water is diverted from the Snowy River, the flow will be as low as a million acre-feet, half of which will be lost through evaporation and other causes. Therefore, unless flow is regulated by means of further storage, South Australia would be limited to 500,000 acre-feet in a drought year and would therefore need to restrict development to this low figure. Urgent requirements to keep pace with the present tempo of development within South Australia are: duplication of the Morgan-Whyalla pipeline for stock and domestic water and for industrial purposes, notably at Whyalla; a new pipeline from the River Murray to Adelaide, Australia's fastest-growing capital city; and more irrigation water to supply extensive new developments along the Murray which will replace large acreages of vines lost as the result of Adelaide's tremendous urban expansion of the last decade. It is anticipated that South Australia's annual water requirements from the River Murray will reach 500,000 acre-feet before 1970, hence the urgent need substantially to increase water storage.

The sanction of the three state governments was required for this proposed dam because each is a participating body in the River Murray Commission, and also because considerable areas in New South Wales and Victoria will be inundated. The planned new storage will be used to impound water during periods of excess flow and to regulate discharge during periods of low flow. Even when New South Wales and Victoria develop their irrigation to the safe limit, the average annual flow to South Australia will be about six million acre-feet. A large capacity regulating storage, therefore, would confer immense benefits by substantially increasing the flow in dry years. Even if the new reservoir added only 500,000 acre-feet in a drought year, the total amount available would be a million acre-feet—a volume which would meet South Australian requirements for many years to come.

The site for the dam is on the River Murray thirty-seven miles upstream from Renmark, near the border of South Australia, Victoria and New South Wales. The dam will consist of a concrete section, a thousand feet in length, built in a new channel excavated across a bend in the river. This section will include a shipping lock and eighteen floodgates. The remainder of the dam will consist of an earth bank three and one third miles in length, averaging forty-one feet high and requiring 3,750,000 cubic yards of earth to fill.

The dam will raise the river level behind it 35 feet 6 inches and will back the river for 123 miles to Wentworth in Victoria. A lake sixty miles from west to east, twenty miles wide in its broadest section, but with an average width of seven miles, will entirely submerge 400 square miles of barren semidesert mallee wasteland. Lake Victoria will also be entirely submerged. The dam, with a capacity of over 4,750,000 acre-feet, will be easily the largest in Australia, dwarfing Lake Eucumbene in the Snowy Mountains scheme (3,860,000 acre-feet), Eilden Reservoir in Victoria (2,750,000 acre-feet), and Hume Reservoir on the River Murray (2,500,000 acre-feet).—G. Ross Cochrane

NEW ZEALAND RAILWAYS. As in many other parts of the world, railways in New Zealand are passing through a transitional stage marked by the change from steam to diesel and electric traction and by the need for retrenchment, rationalisation and reorganisation in face of effective competition from other forms of transport. The last steam locomotive for British Railways has just been built—a state of affairs which existed in New Zealand in 1957 with the completion of the last four engines of the Ja class—but the New Zealand Government Railways still lag behind their European and North American counterparts in the provision of better services in answer to those offered by air and by road. Nevertheless there is an awareness of the situation. As the general manager states in the 'Report of the Railways Department' for the year ended 31 March 1960 (*Append. Journ. House of Repres.*, D-2): 'Throughout the year there was a continuing emphasis on the attraction of business and on economy in operation, with encouraging results. . . '

Chief aspect of this economy in operation was the closure of branch lines: the Oxford, Waikaia and Ngapara branches in the South Island, and the Kaihu and Foxton branches and the Milson industrial line in the North Island, a total of a little more than ninety-two miles. On the other hand, just over eight miles of new line were constructed, most of it being the Longburn-Milson-Roslyn deviation, and consequently the total reduction in miles open for traffic fell from 3,420 in 1959 to 3,336 in 1960. The other major contribution to economy in working was the extended use of diesel traction, and nearly a quarter of all train-miles run fell within this category.

Yet, despite economies, the undertaking as a whole operated at a loss, though at a reduced loss compared with the last two years. Parochially-minded North Islanders found further satisfaction in that the loss was on the South Island system where decreased tonnages of coal and agricultural produce were moved by rail. No distinction is made in the statistical tables between passenger traffic receipts in the two islands, but one would suspect that long-distance journeys in the South Island have shown a smaller percentage decrease than those in the North Island. The reasons for this lie at the root of the decrease in interurban, as against suburban, passenger traffic receipts—namely, convenience of services. The need for an overnight train between Auckland and Wellington has long since disappeared with the development of air transport. Requirements today are for speedy transit with no time wasted in Wellington if one is bound to and from the South Island. In short, expresses with refreshment facilities provided on the trains, stopping at fewer stations, and connecting with interisland shipping are now essential. The trains would, moreover, have the attraction of daylight runs, and could be diesel-hauled over much of the distance because heating facilities would be less in demand.

The experimental run of a diesel-hauled express from Wellington to Auckland and back during the year augurs well for the adoption of a more realistic rail service—realistic in the sense of seeking to meet public needs rather than perpetuating a system because of so-called operating requirements. The introduction of a rail ferry from Wellington to Picton—also mentioned in this annual report—opens up even wider possibilities, particularly of through passenger traffic, although all that is envisaged at the moment is the carriage of railway waggons, and probably motor cars, together with deck passengers, across Cook Strait.

Meantime freight traffic conforms to a pattern that suffers little change from year to year. Products of mines and quarries still constitute more than a fifth of all tonnage handled, animals and animal products 17.6 percent, and forest products 15.1 percent. This last item has shown a significant increase over the last three years—at the expense of products of mines—and is a reflection of the expanding exploitation of the exotic forests of the Volcanic Plateau, and, in particular, of the movement of logs from the Kaingaroa forests through Murupara to the timber, pulp and paper mills at Kawerau. During the year under review Murupara despatched almost 265 million super feet of timber, and Kawerau received a little more than 255 million. No longer do native timbers provide the bulk of the traffic. National Park, Mangapehi and Taumarunui lag considerably behind Murupara, Kawerau, Rotorua and Kinleith, and in the South Island, the major source today of native timbers, Ross, Ngahere and Tuatapere despatched only half the quantities characteristic of North Island stations.

Of the commodities which showed a significant fall in tonnage handled in 1959-1960, coal and grain were the largest. The reduction in coal traffic is symptomatic of the times: the railways themselves used less, domestic consumers preferred electricity, whilst industry, mindful of past experience, sought every other means of power. The result has been near-crisis in Westland. Carriage of manures and phosphates increased by more than 75,000 tons and in 1959-1960 constituted 8.75 percent of all freight tonnage—a figure which varies from year to year as a result of fluctuations in the prices of wool, meat and dairy produce. In all, twenty-three percent of freight tonnage emanated from the farm, providing twenty-three percent of the freight revenue. Lime, coal and road metal were less lucrative, the corresponding figures being 20.2 percent and 12.5 percent, and those for timber 15.1 percent and 10.2 percent.

The regional patterns of farming and general economic activity in the dominion are demonstrated in the returns for each station, and show slight changes of emphasis from year to year. In the present report the relatively high rank of Te Awamutu as a centre despatching cattle and sheep is a commentary on land development on the northwestern fringe of the Volcanic Plateau, whilst the smaller figures of all South Island stations compared with those of what might be considered their North Island counterparts emphasise again the dominant role of the latter island in the New Zealand economy. It would appear that in the North Island the railway has a future, but that in the South Island much remains to be done in the way of integration of transport patterns and of development in terms of overall planning. In view of this the proposed Nelson-Picton railway may be a dubious venture, but it is possible that the government is hoping that the Cook Strait ferry will do much to encourage new traffic—as well it might if problems are tackled immediately, if opportunities are seized, and if common sense, allied with vision, becomes a guiding principle. Too often in the past have the railways of New Zealand been trammelled by political expediency.—JAMES W. FOX

POWER FROM THE WAITAKI. In the preceding number of this journal an editorial footnote referred to the new power station on the Waitaki River as Aviemore. When the *New Zealand Geographer* was in the press it became apparent that a mistake had been made as a result of the misinterpretation of a decision by the New Zealand Geographic Board published in the *New Zealand Gazette* of 4 February 1960. A recent letter from Mr L. J. Stenhouse to the Editor confirms this point.

Any confusion over the siting and naming of the hydroelectric power stations on the Waitaki River may be dispelled by reference to the 'Ministry of Works Statement' for the year ended 31 March 1960 (*Append. Journ. House of Repres.*, D-1) which reports that Aviemore, previously called Okaitu, is situated at the head of Lake Waitaki, and will probably be the next station to be constructed. As yet only preliminary investigations have been made. At Benmore, further up the Waitaki, work is proceeding towards the diversion of the river in the late winter or early spring of this year, some months ahead of schedule, and when the statement was issued the culverts were rapidly nearing completion and the upstream coffer dam, which forms part of the main earth dam, was finished to the prediversion stage. Benmore has a designed capacity of 540,000 kW.

OBITUARY. Dr Sheila Crawford died in Bangkok on 17 March 1960 of a fever contracted while on an expedition to the remote north of Thailand. Born in 1922, she was a student at Canterbury University College during the years 1940-1944 when she gained the M.A. degree with honours in history. Concurrently she studied geography to an advanced level. After teaching in North Island schools she made an extended visit to Britain where she held teaching posts in English grammar schools. Continuing her geographical studies at Birkbeck College, she carried out fieldwork in Denmark, Switzerland and the Netherlands. The results of this work on the dairy industry were presented in a doctoral thesis for the Ph.D. degree awarded to her by the University of London. On her return to New Zealand by way of the Middle East and India, she taught at the Christchurch Girls' High School until her appointment in 1956 as Lecturer in History and Geography in the graduate division of the Christchurch Teachers' College. Her lively interest in the Southwest Pacific area led to her visit to New Guinea and to the expedition for which she had leave from the Teachers' College in the first term of 1960.

In her untimely death academic geography suffers a grievous loss. She was a vigorous and stimulating teacher, one of her own main interests being in tramping and mountaineering. Her work for the Youth Hostels Association was recognised by her election as president, and for this especially she will be remembered gratefully by a host of young people.—G. JOBBERNS

IN OUR CONTEMPORARIES

In New Zealand Journals . . .

Fifty Years Ago

NEW ZEALAND JOURNAL OF AGRICULTURE, Vol. 100, No. 6, June 1960.

The June issue of the *New Zealand Journal of Agriculture* marks the fiftieth anniversary of the first publication of the periodical. The usual articles have been replaced by a major essay written by Mr P. R. Stephens, and a number of short surveys outlining the changes in New Zealand agricultural practices as described in the pages of the *Journal* over the past fifty years. These latter surveys include the changing use of fertilisers and lime, the development of scrub and pumice land, the growth of seed certification, and the expansion of irrigation.

The major article reviews New Zealand farming as it was fifty years ago. While 1910-1911 are taken as the culminating years, the article does in fact treat the whole of the previous decade for, as Mr Stephens points out, 'it is difficult and often misleading to lay stress on particular dates'. The topics discussed include land and livestock, tussock, surface-sown and ploughed grassland, cropping, sheep and cattle, noxious weeds, fruit growing, trade and transport, research and extension, and the farming prospects in 1910.

By the first decade of the twentieth century, farming in New Zealand had reached the stage where no further major changes were to be effected, and the landscape was gradually taking on the aspect so well known today. Over the next five decades the major emphasis was to be on the intensification of production on existing farmland rather than on the bringing of new land into cultivation. The development of the South Island had lost momentum, and the total area farmed had changed little over the previous thirty years. The bonanza grain farms of the plains and downlands had been replaced by a more mixed type of farming economy in which the rearing of fat lambs for the frozen-meat trade was significant. The native tussock grassland survived only in the high country, and the decline in carrying capacity consequent upon regular burning, overstocking and the depredations of rabbits was beginning to cause concern. On the other hand, the future lay with the rapidly developing North Island. Between 1870 and 1910 about ten million acres of land had been cleared of bush and, although the era of the bush-burn was coming to an end, charred and half-burnt logs were still characteristic of many paddocks of surface-sown pasture.

About 1910 new pasture was being established throughout the dominion at the rate of approximately 250,000 acres a year. Although fertiliser imports were rising, there was as yet little done in the way of the topdressing of grasslands despite preliminary experiments by the Department of Agriculture. The manuring of crops, however, was significant and in the decade before 1910 crop acreages had increased. The expansion of the fat-lamb industry demanded increasing quantities of feed crops such as turnips and rape, thus offsetting the decline in wheat planting.

Sheep rearing was still the major livestock activity. The number of sheep rose from twenty millions to almost twenty-four millions in ten years, and the ever-increasing emphasis on fat lambs was reflected in the rise in the percentage of breeding ewes from forty-four to fifty-one. The number of dairy cows almost doubled to 634,000. The Shorthorn still remained the favourite breed for both dairy and beef purposes, although in Taranaki and the Waikato the Jersey was increasing in popularity, as was the Ayrshire in South Island dairy regions.

Mr Stephens is to be congratulated on his article, for it is interestingly written, comprehensive in coverage, and bears the hallmarks of detailed research. Contemporary photographs are included which vividly support the textual descriptions. The geographer might have hoped for a fuller treatment of the regional differences which existed at the time, but a more serious criticism is the complete absence of maps. How much more valuable the article would have been had it included maps showing even such simple data as distributions of livestock and acreages of cropped land. Overall, however, the June issue of the *Journal* is a valuable contribution to the story of New Zealand agriculture, and it should find a place in the library of all geographers.

—R. P. HARGREAVES

AN INVESTIGATION OF DROUGHT

THE OCCURRENCE OF AGRICULTURAL DROUGHT AT ASHBURTON, NEW ZEALAND: D. S. Rickard, *N.Z. Journal of Agricultural Research*, Vol. 3, No. 3, June 1960, pp. 431-441.

This study is concerned with the determination of the frequency, duration and agricultural significance of droughts at Ashburton. Previously there have been many proposed definitions of drought, a number of which are based on the occurrence of a certain number of days receiving less than a specific amount of rainfall. These definitions have not been satisfactory for agronomists because they do not consider either the variable amount of water needed by the vegetation from day-to-day or the soil moisture content at the beginning of the period of insufficient precipitation. Since plants can make use of water stored in the soil to mitigate the effects of a lack of rainfall, drought only begins when plants can no longer obtain the required amounts of moisture. The onset of drought conditions, then, cannot really be defined from the precipitation record alone when it is obvious that the moisture supply, the precipitation and the stored soil moisture must be compared with the water need.

The author takes cognisance of these factors and defines agricultural drought as existing when the 'soil moisture in the root zone is at, or below, the permanent wilting percentage. The condition continues until rain falls in excess of the daily evapotranspiration.' He also points out—and rightly so—that the wilting point of a plant need not be the first indication of drought conditions. A restriction on the amount of water available for a plant may retard its maximum growth rate long before wilting point is reached.

From an examination of forty-four seasons, using Thornthwaite's method of estimating changes in soil moisture, the occurrence of agricultural drought was plotted. It was found that drought occurred in every season studied with an average of fifty-nine drought days per season. A great range from this average was found, and although almost three-fifths of all days of drought occurred in spells of ten consecutive days or more, it was not possible to establish any periodicity in its occurrence. The seasonal distribution of drought periods between the months of September and April inclusive is graphed. There is no evidence of drought conditions in either September or October, but on two occasions they are stated to occur in May. One wonders why the author has found it necessary to delete any record of May from his graph when it would seem desirable to know the length and occurrence of drought in this month.

Scatter diagrams show the seasonal production of pasture and lucerne negatively correlated with the total days of drought in a season. The correlation coefficients are significant: −0.91 for lucerne, and −0.92, −0.58 and −0.95 for pastures. Pasture production in an average season of fifty-nine drought days would be about half that in a season with no agricultural drought.

Although short in length, the paper is a valuable addition to a somewhat meagre library on agricultural climates in New Zealand. It is to be hoped that, with New Zealand's almost complete dependence on a grassland economy, further research and published results will follow. Curry's doctoral thesis is virtually the only other contribution in this field.—J. S. WHITELAW

THE ASIAN AND PACIFIC REALMS ENCOMPASSED

PACIFIC VIEWPOINT, Vol. 1, No. 1, March 1960, pp. 122.

The appearance of the first issue of a second geographical periodical in New Zealand marks a major stage in the development of the subject in this country. If its publication may seem to be an unduly ambitious undertaking for the geographers of only four comparatively small departments of geography to support in addition to the *New Zealand Geographer*, it must be said at once that in its purpose and organisation *Pacific Viewpoint* has set itself a path that is clearly complementary to that of the older journal, and it is to be welcomed for that reason. The aim of the *New Zealand Geographer* has consistently remained that set out by Professor Jobberns in the first issue in 1945: 'the main function of this journal will be to interpret our country to ourselves and to the outside world'. This was amplified by the editor who added: 'It hopes to be of assistance in the affairs of the Dominion, in the solution of its problems—internal and external—and in the further development and conservation of its resources—natural and cultural'. *Pacific Viewpoint*, on the other hand, in the words of its editor, aims to provide a journal 'which, while basically geographical in its emphasis, would be able to present the work of scholars in the social and natural sciences who are also concerned with this regional field'—the Asian and Pacific countries, which are of growing world importance. Diversity of viewpoints and a wide range of contributors are anticipated.

The contents of this first issue reflect this concept with its wide objectives. Jacques Barrau, formerly plant introduction officer of the South Pacific Commission, and now executive officer for economic development, gives an historical sketch of the place of plant introduction in the economic welfare of the tropical Pacific islands.

It was already significant in pre-European days, and became increasingly so with European influence, both directly through plantation development and indirectly through native forms of production.

The new institutional framework of rural China and its striking successes in liberating the energies of the people in many directions are considered by Keith Buchanan, who visited China in November 1958 at the invitation of the Chinese Academy of Sciences. He reviews the application of modern ideas and techniques in the several fields of rural activities, and shows that the problem of productivity has been overcome in ways that were quite impossible to employ under the former social pattern. The revolutionary impact of the new society has led to more success in a decade than has attended centuries of effort before. Buchanan uses recent sources widely, including Chinese publications, but one is left with the impression that his attempt to comment on the whole field in such a wide sweep has precluded personal evidence. Remarkably few lines can be attributed to Buchanan's own field observations, though he was in the country travelling, as his photographs show, over a great deal of China, in the beginning of the year of the 'Great Leap Forward'. Almost nothing is given that can be regarded as a geographer's critical on-the-spot assessment of the picture portrayed in official statements and reports. Certainly he makes one valuable comment on the expansion of irrigated areas: 'the newly irrigated area would be more accurately classed as capable of irrigation by newly constructed works'; and, again, he refers to the 'striking shelter belts that now form gridded patterns on the plain of North China'. But these are disappointingly rare examples of personal observations. Moreover, quite apart from theoretical arguments and the whole 'rectification movement', it is known from Chinese sources themselves that there has not been unqualified support for the major changes in rural communities.

In *China Reconstructs*, published in Pekin in December 1958, it is said of the development of the communes: 'Just as in all previous movements, the Party relies on the former poor and lower middle peasants, who will benefit most from the communes . .' Again, the same journal stated, in December 1959, in commenting on the question of ownership of farm equipment by the small brigade group and by the large commune, 'it would not be good for the unity of the membership or the development of production' if all equipment were at this stage to be vested in the whole commune. Comments on the existence of such problems touched upon by these Chinese reports would have been welcome to supplement Buchanan's broad uncritical statements on the commune system with 'its enthusiastic adoption by the peasants through the length and breadth of China'. However, Buchanan gives a convincing and sympathetic picture of the accelerating transformation of the rural scene, including the establishment of industrialisation in a form new to the world—through the rural communes themselves.

The longest contribution to this issue is a review article by R. F. Watters, of the Department of Geography at the Victoria University of Wellington, in which he examines the conditions under which shifting agriculture exists. The variety of forms is closely analysed in a scholarly article, and the functional interrelations of climate, soil, slope and vegetation are seen to be significant influences upon the local nature of the type of shifting agriculture to be found. With numerous detailed references to local studies throughout the tropical world, Watters has provided a valuable survey of the problems to be tackled in this complex field.

Political geography is represented by McGee's analysis of the conditions that have favoured the development of nation states in Southeast Asia. Western penetration of the whole region has been accompanied by instability, both social and political, and McGee wisely calls for a deeper appreciation of the reasons underlying such a situation before accepting the superficial view that this instability stems from Communist subversion, and could be stopped by military policies of containment. The present phase of nation building and the modernisation of outmoded economic and social systems are inevitable consequences of impact with the West. The forms and scale of western aid, financial and technical, have not yet been sufficient to influence events appreciably, and McGee's appeal for a closer understanding of the characteristics of the situation is a sound one.

Five review articles are contributions to 'The Asian and Pacific Scene' and these notes by authoritative writers fulfil a useful purpose in commenting on material not yet available in textbooks. The coverage from Japan to Indonesia, Australia and New Zealand is well balanced. The final section of reviews of geographical publications includes a welcome contribution from V. Stace, of the staff of the Reserve Bank in Wellington, on the report on Fiji prepared by Professor O. H. K. Spate.

This first number of *Pacific Viewpoint* gives an overall impression of an awareness of the Asian and Pacific world as one undergoing exciting and accelerating change. One can feel conscious of the writers' reactions to the vital winds of change that seem to be blowing through the bamboos which provide an attractive cover design. Though this issue lacks examples of detailed local geographical field studies, it provides stimulating reading, and its effect is enhanced by the high standards of production of type, maps and photographs on good-quality art paper. Professor Buchanan's own guiding interest in the social geography of the non-European world is clearly apparent, and he and his staff at the Victoria University of Wellington are to be congratulated on putting into effect the conceptions expressed above. The appearance twice yearly of *Pacific Viewpoint* should bring a fresh awareness of the fundamental nature and vast scale of the struggles going on in the 'Near North' towards modernising the economy and raising the standards of living of a large proportion of the human population of the earth.—R. G. LISTER

REVIEWS

Tales of Exploration

GREAT DAYS IN NEW ZEALAND EXPLORATION: THE BUSH AND THE RAIN. By John Pascoe. Wellington: A. H. and A. W. Reed, 1959, pp. 192, 18s. 6d.

Geography has always, and rightly, been intimately linked with exploration, even though today exploration may be of our own apparently known city and countryside rather than of the uncivilised or unknown. For the sedentary among us Mr Pascoe in his latest offering provides a companion volume to his *Great Days in New Zealand Mountaineering*. Both books are part of Reed's enterprising and readable series on various phases of New Zealand life, history and geography.

To his credit, Mr Pascoe lays no claim to cover coherently the field of New Zealand exploration: he rightly directs attention to the very adequate work of W. G. McClymont which has recently been republished. Without strain McClymont has covered the work of a hundred or so explorers and their many expeditions within a slimmer volume than Pascoe's. Mr Pascoe has centred his attention on one notable journey of each of eighteen selected explorers and, in his own distinctive racy way, describes these journeys and comments on the topographical problems faced and solved. In addition he recreates the hopes, fears, difficulties and dangers faced by each party and attempts to give perspective to their achievements.

In this reviewer's opinion some of this latter interpretation could have been omitted. The stories of Brunner's year and a half struggle on the West Coast or of Charles Douglas's journeyings in South Westland are best left in the explorers' own modest words. But for those without experience of the bush and the rain and of the regions explored, Mr Pascoe enlarges appreciation of what their traverses meant. His selection of the eighteen explorers is sound, the provision of an adequate map for each explorer is excellent, and the photographs are aptly chosen. As George Lowe says in his foreword: 'John Pascoe is a good story teller, and he recounts these [stories] in his own sincere dedicated way.'—W. P. Packard

New Zealanders Today and Tomorrow

A SURVEY OF NEW ZEALAND POPULATION: An Analysis of Past Trends and an Estimate of Future Growth. Compiled by the Town and Country Planning Branch, Ministry of Works. Wellington: Government Printer, 1960, pp. 287, 45s.

During the postwar years there has been much interest in the likely future trends of New Zealand's population. That this is a topic of major importance in planning for economic development is obvious, and is the basic reason for the appearance of works such as *The Future Population of New Zealand* by G. N. Calvert in 1946 and 'Population Projections, 1955-80', a supplement to *Monthly Abstract of Statistics* in June 1958. The Town and Country Branch of the Ministry of Works has attempted a much bigger task than either of these earlier works—nothing less than a survey of the 'reasons for the differing population trends and rates of change from one district or region to another' since 1921 and an 'estimate of population growth up to 1980 for each local authority in the country'. Obviously complete success was impossible, and the degree of success achieved can, in fact, be assessed as only fair.

The survey is in three parts. Part I considers national aspects of population growth. This was the simplest part of the task and the one most successfully executed. Here, in the predigested form of maps, together with text, is a most useful summary of growth patterns during the four intercensal periods between 1926 and 1956. Rural and non-rural populations are considered separately and the latter are subdivided into 'urban-area population' (in effect the fifteen largest centres) and 'town population' (the remaining boroughs, together with towns of over 1,500). In this section, the country has been divided into twenty-two regions (one, Fiordland, is not considered in the text) 'in which the component counties show population trends that are generally similar in character'. The division is a useful one and the maps, showing percentage changes by shading and numerical change by proportional circles, are striking. One might quibble about the lack of consistency in the inclusion of lakes on Figures 13, 14 and 16, but not on Figure 15; about the reversed angle of shading for Central Otago in Figure 12; and about the cluttered appearance of several of the maps of town population. Where circles overlap the conventional technique of leaving a narrow white strip between them would have helped clarity. Part I concludes with well illustrated sections on age and sex structure and internal migration. In general, Part I is satisfactory.

'Part II contains tables and explanatory text detailing the population history of all local authority areas between 1921 and 1956'. The tables are most useful, particularly as they take account of the nightmare of changing administrative boundaries. But the text is singularly superficial—in fact it is hardly 'explanatory' at all, offering simple glib statements that stress the facts most obvious in the tables. Many examples might be cited. The different rates of growth of Waikato towns are remarked on, but no explanations are offered; the population of Waihi is noted as being static, but there is no mention of the closure of the Martha mine or any other explanation. In the case of Taupo, the town's growth between 1945 and 1951 is attributed to land development to the north. In fact it was not until about 1953 or 1954 that land development had any effect on Taupo, and the two major reasons for growth over the period 1945-1956, namely, timber development (four new mills were opened in Taupo during the period) and the Wairakei geothermal project, are not even mentioned.

One curious feature of Part II is the abandonment of the population regions defined in Part I in favour of so-called 'provinces' and 'subdistricts'. Comparison reveals that, in fact, ten of the subdistricts have the same boundaries as the population regions. It would have been much more purposeful, and much simpler for comparative purposes, if the population regions had been used as the framework in Part II. To have to look up Lake County under Southland in Part I and under Central Otago in Part II is needlessly confusing. Furthermore it is high time that government departments conferred and standardised what is meant by terms such as 'province' and 'provincial district'. In the survey under review, yet another map of provinces is produced with boundaries which are neither Land Districts nor Provincial Districts.

Part III gives estimates of population up to 1980 for every local authority area. The 'extreme difficulty of estimating future population on a local authority basis' is acknowledged. The Government Statistician's projections to 1980 for the whole country have been accepted as the framework within which the local authority populations have been fitted. The local estimates are based on past trends with account being taken 'of the major factors likely to affect population growth: e.g. population structure (age and sex); future development of industry; farming potential; changes in the function of an area'. In view of the superficial 'explanations' given for past growth in Part II one can only be sceptical about the thoroughness of the examination of factors likely to affect growth. No indication is given in the text of any more than the most general assumptions of future economic developments. It will be an interesting exercise for someone in 1980 to compare the estimates with reality.

Two of the basic faults of the Town and Country Planning Branch's earlier publication, *West Coast Region*, are again evident in the present survey. In the first place, for such a survey of probable growth to be really satisfactory, a great deal of detailed, on-the-spot fieldwork would be necessary and the present survey shows no evidence of this having been carried out. Secondly, the separate parts of the final report remain too separate. The text is repetitive from one part to the next and seems to reflect multiple authorship without sufficient tying together at the top and at the end. But this can only be an assumption as unfortunately the contributors are unnamed—a regrettable and unnecessary practice maintained from the earlier publication. However, despite these criticisms, which are essentially criticisms of the organisation and planning of the volume, one can only admire the great amount of laborious compilation and calculation which such a small group has put into this work.—R. GERARD WARD

TRIBUTE TO AN ANTHROPOLOGIST

ANTHROPOLOGY IN THE SOUTH SEAS. Essays presented to H. D. Skinner. Edited by J. D. Freeman and W. R. Geddes. New Plymouth: Thomas Avery & Sons, 1959, pp. 267, 42s.

In order to pay tribute to Dr H. D. Skinner, the academic pioneer of anthropology and archaeology in New Zealand, former students and colleagues decided to publish a volume of essays on the occasion of his seventieth birthday. The value and importance of this scholar's service to anthropology in New Zealand and the Pacific make it a fitting method of honouring his work and achievements. The editors, Drs J. D. Freeman and W. R. Geddes, indeed all the authors, are to be congratulated on the production of a volume which is at once a fine acknowledgement of their debt to Dr Skinner and a very real contribution to anthropology.

The essays open with a memoir of Henry Devenish Skinner by Dr Freeman. In some nineteen pages he unfolds something of the career of his old teacher from boyhood to honourable retirement. The memoir discloses the breadth and vision of Dr Skinner in his lifetime of work for the University of Otago and the Otago Museum.

The memoir is followed by 'Culture Change in Prehistoric New Zealand' by Jack Golson, who reviews the perspectives in New Zealand prehistory and proposes a classification system. It may come as a surprise to some to find his recommendation that the term 'Moa-Hunter' is not satisfactory, and he proposes instead 'Archaic' as being more appropriate for the earliest phase of prehistory in New Zealand. For the latest phase he uses the term 'Classic Maori', a term which already has a loose hold in archaeological literature.

Leslie Lockerbie writes on a related theme in a well-illustrated article, 'From Moa-Hunter to Classic Maori in Southern New Zealand'. In his introduction he stresses that a climatic change has occurred in New Zealand during man's occupation of the country. He produces evidence of stratigraphy, and quotes his earlier work to show that, at Kaikai's Beach, excavation unearthed Moa-Hunter material at a depth of 7 feet 11 inches, while near the surface Classic Maori material was discovered.

Five carved wooden figures of human form described by Dr T. T. Barrow represent the reward of patient delving in oversea museums. An unusual feature is the attachment of human hair to give a more realistic appearance. Dr R. Duff relates his classification of Maori adze types to Polynesia and Indonesia in an essay on 'Neolithic Adzes of Eastern Polynesia'. His types seem well established and he sums up by stating that 'no better evidence than adze distribution can be found for testing Heyerdahl's theory of an American origin on Polynesian culture, and, no less, Andrew Sharp's thesis of the one-way drift voyages as the mechanism of internal Polynesian settlement'. Duff considers that the evidence of adze distribution lends no support to either theory.

Writing about 'Ritual Adzes in Tikopia', Raymond Firth mentions that although a distinction usually exists between implements of technological and ceremonial use, in Tikopia important adzes restricted to ritual purposes could be replaced by implements formerly employed for technological purposes.

An attempt to determine the meaning of songs, dramatic performances and artistic emblems, all forming part of a unified ceremony, is portrayed by Dr Catherine H. Berndt in her article 'Ascription of Meaning in a Ceremonial Context in the Eastern Central Highlands of New Guinea'. It would seem that to the participants themselves the meaning is not wholly clear, as each emblem maker does not communicate what his emblem represents to others in the group.

One of the co-editors, Dr J. D. Freeman, has searched the early literature of Samoa, including the manuscript journals and letters of early missionaries to produce an interesting essay on 'The Joe Gimlet or Siovili Cult'. This cult, the author suggests, belongs to the same type of religious movement as the more recent cargo cults of Melanesia. It began in Eva in 1830 and spread quickly, first through Upolu and then to neighbouring islands. Siovili, or Joe Gimlet, so named because of his skill in manipulating the *vili*, or Samoan reciprocating drill, gave his name to the cult. It was based on some aspects of the newly-expounded Christian doctrine grafted on to elements of the old Samoan religion. The extended travels of Siovili gave him ideas and a sense of power. Although Siovili is not heard of after 1841, his cult persisted into the 1860's, and in the face of determined missionary opposition.

The other co-editor, Dr W. R. Geddes, writes convincingly about 'Fijian Social

Structure in a Period of Transition'. He comments in his opening remarks that the Fijian, despite the impact of other cultures, still retains a great deal of his 'traditional social culture'. He then defines the aim of the essay, which is 'to describe the traditional structure, to analyse some of the more important changes which have influenced it, and to indicate what may be the effects upon it, and upon the cultural life of the Fijians which it sustains, of further changes'. In conclusion he mentions that his theoretical interest, his sketching of some general features, may help in improving modern developments in Fiji.

The historian, Angus Ross, provides an essay entitled 'Maori and Polynesian: Race and Politics'. He proceeds to show that New Zealand's responsibility to her Maori people led to further responsibilities, first in the Cook Islands, and second in the islands of Western Samoa. Various administrators from Sir George Grey onwards argued that familiarity with the problems of one Polynesian people fitted New Zealand to grapple with the problems of other Polynesians. He records that despite this experience and some successes, mistakes were also made.

John Booth, of the Department of Maori Affairs, gives in 'A Modern Maori Community' the result of fieldwork carried out at Panguru on the Hokianga which he commenced in 1952. After tracing the historical development of the area he describes recent changes: ideas on land tenure are undergoing a shift of emphasis, and there is the feeling that the individual should control his farm—members of the same family have even sold their share in land to one member so that he possesses full control. The Department of Maori Affairs set out to assist the community to make changes under the continually-varying conditions, and set up, with the approval of the community, an Investment Society charged with a plan for implementing cooperative savings and credit. Opportunities for increased leadership have been offered to members of the community.

The final essay by D. W. Borrie refers to 'The Maori Population: A Microcosm of a New World'. Professor Borrie, after examining population figures and vital statistics, concludes that the growth of Maori population is so vigorous that the balance of Maori and non-Maori will be considerably altered in the future. For a lengthy period a high mortality rate offset high fertility, but now the upward rate of increase in population has reached 3.5 percent per year.—V. F. FISHER

A NEW SCHOOL ATLAS

OXFORD ATLAS FOR NEW ZEALAND—STUDENTS' EDITION. Advisory Editor, R. G. Lister. London and Wellington: Oxford University Press, 1959, pp. 71, 15s. 6d.

This is certainly an attractive atlas for school use. It begins with a comprehensive 'legend' which is followed by a section of New Zealand maps including five very useful and informative statistical maps and one physical map on one page. There are then five smaller maps showing New Zealand annual rainfall, geology, vegetation, land use and air routes; each island is then drawn on a double-page opening with large-scale insets of the areas around the four main centres. Then follow sections on the South Pacific, and Australia, and a map of the Pacific area as a whole leads on to a series of double-page maps of the continents, Western Europe, British Isles, Canada, the United States and Antarctica. There are a few inset maps of special areas and the final section contains twelve world distribution maps. Some world statistics precede a gazetteer for New Zealand, Australia and the South Pacific. The whole makes up a most useful set of maps for post-primary schools and should take a pupil through to the school certificate stage when supplemented by textbook maps and diagrams.

The relief maps show altitude by layer-colouring, each layer bounded by an invisible contour and supplemented by 'hill shading'. This gives a pleasing and effective result for land areas but has not proved so successful when applied to ocean depths in the Pacific Ocean. The type is very well chosen for legibility except that in one or two cases, notably the half-page distribution maps for Australia, it is rather too small for comfortable reading. The statistical maps of New Zealand are particularly well prepared, giving an interesting picture of the distribution of the dominion's chief industries and its population. The problem of showing land use on a half-page map of the whole country has been well handled.

The chief virtue of the continental maps is that they show relief very clearly and do not attempt to show too much other detail: they certainly show sufficient for New Zealand schools. This atlas would not take the pupils through the sixth form but is undoubtedly an excellent production for all earlier work. It is a distinct improvement on any recent publications of its kind and can be most confidently recommended, especially as the cost is very reasonable in view of its continuing value through three or four years. The stiff cover will assist in maintaining it in good order through those years.—J. L. Hewland

Tribute to a Master

GEOGRAPHICAL ESSAYS IN MEMORY OF ALAN G. OGILVIE. Edited by R. Miller and J. Wreford Watson. Edinburgh, Thomas Nelson and Sons Ltd., 1959, pp. 246, 42s.

Isaiah Bowman is said to have once defined geography as 'what geographers do'. In elaborating the interests of a group of such people, this volume may be regarded as providing an amplification to the definition. The book demands attention on this count alone, but this collection of essays in honour of the late A. G. Ogilvie is also significant because it is a mirror to the character and achievements of Ogilvie himself. Each of the ten essays represents a contribution from one of his former colleagues or graduates, but what may not be immediately apparent is that each also represents a field in which Ogilvie himself had studied and worked. It is evident, therefore, from even a cursory glance at the contents that his interests were wide. During the period from 1931 to 1953 when Ogilvie was the Professor of Geography at the University of Edinburgh, he established no narrow specialistic school but, as was typical of the man, he stimulated, encouraged and actively instigated research into many divergent fields—and to this the essays themselves testify.

The volume is divided into two parts, the first comprising five essays on Ogilvie's native Scotland: its landforms, coasts and problem areas, its cultural contacts, and a regional study in the best Ogilvie tradition. The second part consists of a similar number of essays on oversea topics: North America, the Mediterranean, Africa and the Tropical Lands.

As is inevitable in such a collection, the essays are not all of equal merit. Several may be described as outstanding in that they offer the stimulation of fresh concepts reinforced by the quiet authority of familiarity and scholarship. Into this category fall D. L. Linton's 'Morphological Contrasts of Eastern and Western Scotland' which once again demonstrates Linton's powers of penetrating observation and lucid analysis; R. Miller's disarmingly simple and all-too-brief sketch of Orkney; J. Wreford Watson's application of a technique for the dynamic study of relict features in historical geography; and J. M. Houston's further contribution to social geography in a study of the Plain of Valencia.

In both content and concept, therefore, this volume is a worthy memorial to the achievements of Ogilvie and to his many and varied contributions to British geographical thought and literature. Yet, while approving of the book as a whole, one might have wished that the contributors had been somewhat more critical and meticulous with regard to the maps. It is surprising to find such slips as the disparities evident between the maps on pages 57 and 63; different spellings of the River Chiva between the map (p. 168) and the text (p. 170); the lack of any adequate explanation to the table (p. 172) which, if the formulae quoted are to be taken literally, does not bear arithmetic scrutiny; the inclusion of the illogical category of 'ricefields' on a map purporting to show 'Structure of Settlement' (p. 193); and the frequent absence of scales, (pp. 222, 223, 229 among others).

By contrast, errors in the text are few, though the reader may have a little difficulty (p. 210) where a negative has apparently been omitted. On the other hand, it may be no more than a Celtic puckishness which permits England to be referred to as 'Britain' (p. 56)—an unusual inversion of the more frequent and (in Scottish eyes) unpardonable sin.—W. J. Brockie

From the Lakes to the Sea

THE ST. LAWRENCE SEAWAY. By T. L. Hills. London: Methuen and Co. Ltd., 1959, pp. 152, 12s. 6d.

This short book is interesting from two points of view. First, it discusses a subject of special current interest, and, second, it is written by a geographer who received his early training in New Zealand.

After a section on the geographical setting in which the St. Lawrence Seaway has been built, the author discusses early exploration and the history and problems of the early canal systems. As early as 1895 steps were taken to investigate the possibility of building a seaway from the Great Lakes to the Atlantic by a joint United States and Canadian government commission. Its report 'immediately prompted the organisation of an antiseaway lobby in the United States, a lobby which waged battle successfully for fifty-nine years'.

Arguments for and against the project are adequately summarised. Those ranged against it were bodies or organisations that thought a waterway as conceived would be damaging to their interests. These included the railroads, the Atlantic and Gulf ports, the coal companies and mine workers, private utilities, industrial concerns and towns both large and small. Ultimately, after the second World War, opinion was swung in favour of the project by excessively high demands for electric power in New York

State and adjoining areas in Canada, by the declaration of a United States Senate Committee that construction of the seaway was essential to national defence and, most notably, by the recognition that an efficient waterway was necessary to convey iron ore from the newly-developed Quebec-Labrador fields into the interior of the continent and to carry grain from the prairie provinces to the Atlantic.

The fourth chapter outlines details of the construction work involved—the building of dams, powerhouses, canals and locks—and deals with side effects such as land flooding and the relocation of housing. The fifth and final chapter looks into the future and considers the possible pattern of commodity flow and the nature of freight to be carried.

Having finished the book the reader might profitably return to the introduction to be reminded that the success of the project should not be necessarily judged by the number of ships plying its waterways. It was built primarily to move iron ore and grain in specially-designed carriers and it is as well a 'magnificent achievement . . . in the field of international co-operation'.

The book is well written and illustrated, and since it has arrived in New Zealand at a time when the St. Lawrence Seaway is possibly a favourite project in school geography or social studies classes, it would seem to be an essential addition to every school library. It is an excellent summary, at all levels, for persons interested in the contemporary geography of Anglo-America.—Bryan Farrell

An Anthropologist on Africa

AFRICA: ITS PEOPLE AND THEIR CULTURE HISTORY. By G. P. Murdock. New York: McGraw-Hill Book Company, Inc., 1959, pp. 456, $8.75.

This impressive volume is by the Professor of Anthropology in Yale University. He has attempted the immense task of describing and systematising the cultural development of the native peoples of the whole of the African continent, relying mainly upon the great volume of available descriptive literature. He has limited his survey roughly to the 7,000 years preceding the present century, and his subject matter broadly to food production, division of labour by sex, types of housing and settlement, kinship and marriage, and social and political organisation. The historical approach is maintained throughout and the movement of peoples, the impact of one culture upon another, the rise of powerful states and other matters of historical importance fall naturally into the survey. The author, in one of the early general chapters, notably stresses the significance of linguistic relationships in tracing the movements of peoples; the main body of the work is devoted to the description of the 'cultural provinces' into which he divides the continent. In the course of this, over 800 tribes are listed, giving some indication of the size of the author's task of synthesis. The present reviewer is not qualified to assess this book as an anthropological work but it is clear to him that Dr Murdock has brought to his subject a trained mind and deep scholarship.

There is much of value to the geographer who is interested in the historical or the agricultural geography of Africa. A significant chapter is one in which the author shows how his researches led him to the conclusion that about the time when agriculture, diffused from southwest Asia, was developing in Egypt, an entirely distinct

Negro agriculture, based largely upon the 'ennobling' of local wild forms of millet, sorghum, groundnut and cotton grew up in the region of the Upper Niger, in which general area later developed the states of Ghana and Mali. Another chapter traces the impact of Indonesia through what the author calls 'the yam belt' to the Guinea coast. It is clear that Dr Murdock has some original views on cultural diffusion in Africa. Descriptions of the cultural provinces are buttressed by valuable appropriate lists of African crops and domestic animals, relevant bibliographies and useful maps.

Dr Murdock is not concerned with modern cultural changes in Africa where, over large areas, tribal affiliations and traditional cultures are breaking down and new states are emerging. The reader may well feel that this work could become a source book of dead or dying cultures.—L. S. SUGGATE

METEOROLOGY DOWN TO EARTH

BRITISH WEATHER IN MAPS. By J. A. Taylor and R. A. Yates. London: Macmillan and Co. Ltd., 1958, pp. 256, 21s.

In spite of the title and chapter headings, this is not just another exposition of elementary meteorology. It deserves the attention of teachers of practical courses in geography, for it 'presents a method of geographical analysis and interpretation of the "primary documents" of British weather, viz. the British Daily Weather Reports.' A considerable number of synoptic situations are chosen as representing particular types of air masses, fronts and anticyclones. Using the data from station models on the charts, the distributions of individual weather elements are mapped by isopleths. Each of these maps—of ambient temperature, dewpoint temperature, the difference between these two, cloud, surface wind direction and force, visibility, barometric tendency, present and past 'weather'—is examined, and areas of steep or shallow gradients noted. Thus a composite picture of the weather situation is built up. The technique for calculating the geostrophic wind is outlined, and it is shown how the track of an air parcel at the 2,000 feet level can be traced back historically.

As an introduction to the areal distributions of weather processes in the British Isles, the approach adopted is admirable. One can quibble about the manner in which air masses are treated separately as though their isobars could have no curvature, and the influence of relief features could have been given greater emphasis in interpretation. The reviewer would have preferred to have had fewer surface situations described (since teaching time is limited) and a section included devoted to linking upper winds to surface conditions. However, as an example of the 'synoptic climatology' tradition written for young geographers, it is recommended for sixth-form students. Perhaps teachers may be stimulated to use examples drawn from New Zealand.—L. CURRY

NEW ZEALAND GEOGRAPHICAL SOCIETY PUBLICATIONS

JOURNALS. The New Zealand Geographical Society publishes regularly two journals, the *New Zealand Geographer* and the *Record*, both of which appear twice a year. In the former appear articles on the geography of New Zealand and its Pacific island 'neighbourhood', with occasionally a contribution on Australia. In the latter are published accounts of the activities of the Society and its branches, including synopses and reports of lectures given at monthly meetings.

SPECIAL PUBLICATIONS. In addition, special publications have been produced from time to time. In the Miscellaneous Series have appeared *New Zealand Weather and Climate*, now out of print, and, in the Branch Publications of that series *New Zealand: Inventory and Prospect*. The latter was published by the Wellington Branch and is now also out of print. The second of the Branch Publications, *New Zealand's Industrial Potential*, prepared by the Auckland Branch, will be ready at the end of 1960.

The Conference Series comprises two publications, one relating to the first conference held in Auckland in 1955, and the other to the second conference held in Christchurch in 1958. The first of these is now out of print, the second is available at a reduced price of 7s 6d.

No publication has yet appeared in the Research Series, but submissions are now being actively considered and a first number in the series will no doubt be published in 1961. Also in 1961 another publication in the Miscellaneous Series, a volume of essays, will be available.

TEACHING AIDS. The New Zealand Geographical Society also publishes a series of teaching aids suitable for teacher and class use. These comprise sections of topographic maps, photographs and relevant notes, together with bibliographical lists.

NON-SERIAL PUBLICATIONS. From time to time other publications may appear *hors série*, such as *Maps of Canterbury and the West Coast*, a selected bibliography prepared by the Canterbury Branch as a prototype for a dominion coverage by all branches. Mimeographed, its price is ten shillings.

* * * * *

Enquiries relating to publications, except as follows, should be addressed to the Secretary of the Society, Department of Geography, University of Canterbury, Christchurch. Information on Branch Publications in the Miscellaneous Series may be obtained from the respective branch secretaries.

BACK NUMBERS: *NEW ZEALAND GEOGRAPHER*

The Secretary of the Society would be pleased to receive copies of the *New Zealand Geographer*, Volume II, Number 1, April 1946. For those in good condition payment of thirty shillings per copy will be made. These numbers are required for making up complete sets.

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The New Zealand Geographical Society was founded officially in Wellington towards the end of 1944. Its real foundation, however, took place in Christchurch in 1939 when a group of enthusiasts formed what is now the Canterbury Branch of the Society. Their lead was followed in February 1944 in Wellington, and further branches came into being in Auckland and Dunedin early in 1945.

The aims of the Society as stated in the constitution are 'to promote and stimulate the study of geography'. These are the aims of more than one society in the world, and the New Zealand Geographical Society is particularly concerned with geography in New Zealand. It is therefore the Society's policy to stimulate geographical studies about New Zealand and matters closely related to the Dominion.

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